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Collecting survey-based social network information in work organizations

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ABSTRACT

Collecting social network data among organization members using surveys is challenging and requires a well-considered strategy. Based on extensive past experience with collecting social network information in work organizations with surveys, we identify and discuss four major elements of the data collection process, all linked with and dependent on the specific research question and objective: 1) negotiating access to the organization; 2) identifying the network's boundary, the relevant formal organizational structures that affect social networks, and the sampling approach; 3) deciding how to approach research subjects and collect network data; and, 4) providing useful and ethically-sensitive feedback to the organization and its members. Decisions on each of these elements and their co-alignment, particularly with respect to the chosen research question, is crucial to a successful study. We offer guidelines and provide examples for each of these elements.

1. Introduction

Social network analysis (SNA) can help us understand the human interaction that takes place in a specific organization (e.g., Cross and Parker, 2004), as well as allow researchers to uncover general patterns of social interaction in organizations that go beyond a specific context (e.g., Borgatti and Halgin, 2011; Kilduff and Krackhardt, 2008). Social network analysis relies on information about the *social relations among members of organizations*, which can be linked to members' demographic characteristics, their attitudes, behavior, and cognitions. The pattern of social relations might help explain individual- and group-level outcomes, such as well-being, creativity, and performance. However, despite the potential insights that social network data can provide, collecting such data in an organizational context is often challenging because of a lack of familiarity with network analysis among managers and employees, as well as concerns over data confidentiality.

This paper provides a primer – an integrative overview – of the major steps that should be considered when collecting survey-based network data within organizations, along with numerous suggestions on how to avoid typical pitfalls in executing these data collections. Although a variety of other techniques have increasingly become available to help infer social ties among employees (e.g., sociometric badges, collaboration tools-based trace data, and email data), we concentrate in this paper on how to collect network data using survey methods, because surveys remain one of the primary sources to collect detailed social network data in an organizational context. One example of the unique benefits of surveys is that they can not only tap into existing relations, but also be used to probe desired future relations, which can aid in reorganizing the organization. The paper's primary intended audience is organizational scholars who are fairly new to SNA, though many of the insights about collecting network data via surveys will be of value to anyone attempting a data collection among employees within an organizational context.

We focus exclusively here on collecting social network data among members in organizational settings via surveys because the challenges faced are somewhat different from network data collections through surveys in other settings (e.g., among school students) or collecting network data via other techniques (e.g., studying publicly-posted tweets on the Twitter platform). One important consideration is that organizations have formal structures and interdependent roles, as well as multiple layers of hierarchy and diverse sets of units (e.g., teams, departments), all of which should be taken into account to accurately capture the social behavior within work organizations. Moreover, the agreement of both management and employees is needed in order to execute a survey-based network study properly, and an active strategy is needed to get both engaged in the process. Finally, the potential ramifications of a poor data collection effort with surveys, including an accidental data breach, can impact employees' livelihoods (e.g., by

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affecting their job appraisals, potential for advancement, likelihood for termination), as well as their social standing within their organization or community. Therefore special care needs to be taken to safeguard data protection. Thus, network data collections within organizational settings bring with them specific challenges that must be considered prior to commencing the study.

Based on our past experience with survey-based sociometric data collections in both private and public organizations, we identify and discuss four critical elements of the data collection process. We begin the paper, however, by discussing the specific *research question* you would like to answer, since having a clear and well-defined research question prior to deciding how you wish to collect data is central to any good research design, and this forms the backdrop to which the remaining four elements must be aligned. We therefore first discuss design issues related to generalizability and research scope. We then turn to discussing the other four elements.

In the first element, *negotiating access*, we will deal with issues such as motivating and convincing organizations to participate, gaining the appropriate level of commitment from top management prior to data collection, deciding on what to offer to organizations and their members in return for participation, and holding up-front discussions about confidentiality and ethical considerations. We then tackle the second element, which addresses issues related to *developing a clear a priori network boundary*, identifying who will be included or excluded from the study, and identifying the formal structures that create structured foci (Shipilov et al., 2014) for interaction within the network. As part of the third element – *how to collect data and how to approach research subjects* – we discuss how to build appropriate network questions and some strategies for minimizing non-response. Finally, in the fourth element we discuss *how to offer advice to the organization* on how to improve shortcomings that the study uncovered without violating organizational members' confidentiality and ethical concerns. While we will discuss each of these four elements here in sequence, in practice these elements need to be aligned, which might require the researcher to address these elements simultaneously or revisit them numerous times through feedback loops in order to achieve the necessary level of integration during the study's implementation.

2. The central research question and the four elements

2.1. Defining a central research question

The research question you choose to explore is the central driving force that determines how to handle the four major elements of conducting a social network study. To be able to successfully answer your research question, you must first identify your *target sample* – the organizational members whose social interactions you wish to study (i.e., your "dyads of interest"). In addition, you will need to decide on the intended *scope and generalizability* of your question. A third important aspect is the *level of analysis* at which you will be answering your research question (i.e., the dyadic, individual, or group level). Identifying your dyads of interest, the generalizability that one aims to achieve, and one's level of analysis will inform the type of network data and sampling procedure required, as well as impact the manner in which the target organization(s) will be approached.

2.1.1. Defining the group and "intra-group" vs. "inter-group" relations

There are a number of considerations around the target sample whose network relations you'd like to study and will ultimately be your dyads of interest. Two important decisions include: (1) whether to focus on ties within a specific group or between groups, and (2) how these groups will be defined in the study.

Most work organizations can be split into smaller units, such as departments, teams, or workgroups (e.g., shifts), and therefore identifying the right unit(s) is important because different social and work processes might be expected to take place in each of these organizational layers. Hence, you might wish to study the dyads among all members within (or between) work organizations, or instead might want to focus on dyads in (or between) smaller units, such as departments or teams. For example, Brass (1984) showed how an organizational employee's level of perceived influence was dependent on the network position (centrality) of an employee at three different levels: their position in their workgroup, their department, and in the organization as a whole.

Second, researchers need to decide whether they wish to focus on relations among employees within such organizational units (e.g., intra-group ties), and/or focus on ties among employees between organizational units (e.g., inter-group ties). In the latter case, you might be interested in the relations between teams, between departments, or even between organizations.

2.1.2. Generalizability and scope

A related consideration is determining the extent to which you would like to make a *generalizable* research statement, and hence involves determining the *scope* of your research. In the case of intra-group research, this depends on whether you wish to understand the network structure in a specific setting (e.g., a case study involving a single group or organization) or whether you wish to find general patterns that are valid across groups. In the case of intergroup relations, the question is whether you wish to make statements about the relations between two specific groups, or whether you are interested in more general statements about intergroup relations by looking at relations across multiple units, possibly in multiple organizations, to make the most generalizable statements.

For example, research on a single organization might focus on identifying individuals who act as bottlenecks in a workflow network (cf., Cross et al., 2002), or determining whether individuals central to the organization's friendship network perform better than peripheral individuals (cf., Fang et al., 2015). Alternatively, you might wish to make more generalizable statements about human behavior and interactions beyond a specific context (e.g., whether central individuals typically tend to perform better than peripheral individuals); here data from multiple units are generally needed to ensure the outcomes found are not the result of an idiosyncratic group context. Thus, the researcher must determine whether the research question aims to find something that is valid for a specific group (e.g., a single organization) and thus perform a type of case study (Eisenhardt, 1989; Yin, 1984), or whether it aims to make a broader, generalizable statement on human behavior using quantitative analyses across a greater number of research sites.

Although a large portion of SNA research in the organizational realm aims to make statements that are generalizable to many contexts, in practice researchers often draw conclusions based on a single group, i.e. there have often been statements made that the manner in which social processes work in a particular organization might be generalizable to most other organizations. For example, studying the social hierarchy in a single military training group with no formal structure, de Klepper et al. (2017) suggested that the group's informal hierarchy developed at its founding and persisted without much change throughout their year together. However, without replicating the study across multiple organizations, it is impossible to say whether, for example, future cohorts would have their informal hierarchy evolve similarly. It is also difficult to say if this was a product of a particular type of organizational culture and whether this is generalizable to other types of work organizations.

In the rare occasion when multiple groups are analysed in organizational SNA research, data tend to be collected in multiple organizations. For example, Sparrowe et al. (2001) included 38 work groups from 5 diverse organizations in linking group density and performance, while Oh et al. (2004) examined 60 work groups across 11 organizations in linking intergroup connections and performance. However, most of what we know about generalizable results across settings has tended to come from meta-analyses (e.g., Balkundi and Harrison, 2006) because of the relative dearth of these types of multiple-organization studies, or involves smaller groups (such as small teams) or ego-network

approaches. We will return to this topic when dealing with different sampling approaches.

2.1.3. Level of analysis

A third important decision for any network research concerns determining the *level of analysis*. The most common levels for organizational network research include the *dyadic* (or tie), the *individual* (or nodal), and the *group* (or network) level (cf. Contractor et al., 2006; Mizruchi and Marquis, 2006; Brass, 2012; see Agneessens, 2021 for a more detailed overview).

Research questions at the *dyadic level* focus on the direct or indirect relation between two individual nodes (e.g., organizational members). Most often this level of analysis involves questions about the presence and quality of a tie between two nodes. One of the most "popular" types of research questions at a dyadic level focuses on *why* ties exist between some actors and why they are lacking between other actors, and whether these ties or non-ties are related to the presence of other types of ties between those actors (e.g., friendship ties being appropriated for instrumental purposes), characteristics of the nodes involved (e.g., homophily), or aspects of the triad surrounding the focal dyad (see Contractor et al., 2006; Tasselli et al., 2015; and Rivera et al., 2010 for a more detailed discussion). For example, we might use statistical models such as exponential random graph models (ERGM; Robins et al., 2007), multiple regression quadratic assignment procedure (MRQAP; Krackhardt, 1987, 1988) or stochastic actor oriented models (e.g., SIENA, Snijders et al., 2010) to understand who asks advice from whom (Agneessens and Wittek, 2012), when employees are likely to trust each other (Ferrin et al., 2006), or which employees gossip together and about whom they gossip (Ellwardt et al., 2012).

At the *individual level*, the focus is on the position of a node in the network (e.g., its degree or betweenness centrality) and on the potential antecedents and consequences of those positions. For example, extensive research has examined how individual characteristics such as self-monitoring (Fang et al., 2015) or gender (Woehler et al., 2021a) affect nodal positions in networks, while others have focused on how occupying certain nodal positions in networks, such as broker positions or central positions, might be linked with employee outcomes such as performance and innovation (e.g., Burt, 2000; Baer et al., 2015).

A *group level* approach focuses on the structure of a network or subnetwork as a whole (e.g., its density, level of centralization or fragmentation), and on the antecedents or consequences of such group level structures (e.g., Henttonen et al., 2010). For example, though rarely studied, antecedents such as group gender composition might lead to greater or lesser levels of group leadership centralization (Berdahl and Anderson, 2005). More widely studied are how group density or centralization lead to various consequences, such as the group's quality and quantity of performance (e.g., Kane and Labianca, 2011) or the group's viability over time (Balkundi and Harrison, 2006). We note that such an approach, which requires correlating network structure with some group characteristics, will normally require a whole network analysis across multiple groups. If we, instead, choose only to examine a single group, we would be limited to answering research questions concerning, for example, the identification of a core-periphery structure among the managers involved in an organization's budgeting process (Barsky, 1999).

When we are interested in *links between groups*, i.e. network relations between teams, business units, organizations, or even industries (Cropper et al., 2008; Tortoriello and Krackhardt, 2010), rather than within such groups, the focus might again be on dyadic, individual or group level research questions. For example, at a dyadic level, we might focus on the antecedents of an interorganizational CEO friendship (Westphal et al., 2006) or the consequences of CEOs sitting on other firms' boards as directors on firm performance, as an example (Geletkanycz and Boyd, 2011). Similarly, from a nodal perspective, they might investigate how having links between teams might foster one's own team performance (e.g., Oh et al., 2004).

2.1.4. Combining the dyads of interest with scope and level of analysis

Based on your objectives relative to the above three aspects, you can then develop a clear idea about your data collection objectives. This will aid in your negotiations for entry into organizations, as well as give you a clearer idea on sampling frame and design issues. We illustrate the interconnections among these three aspects through the three examples provided below (Table 1).

As a first example (Study A), you might wish to examine whether teams with greater expertise diversity have higher team performance (e.g., innovativeness), and whether this relationship is mediated by the level of task conflict (density) among team members (cf. Pelled et al., 1999). Since your level of analysis is the group level, your objective would require multiple teams (to compare more vs. less diverse teams and to calculate each group's level of task conflict and number of innovative ideas). Because you want to make general statements which are not impacted by any specific organization's culture or formal structure, this would involve collecting intra-team network relational data across multiple organizations.

In another study (Study B), you might wish to study the emergence of trust between employees embedded in different departments within a specific organization preparing to vote on unionizing. You might wish to examine whether attitudinal similarity between employees with regard to unionizing facilitates trust ties emerging across departments. Here the level of analysis is dyadic and the ties are inter-departmental ties; the study's scope is to understand when interdepartmental trust emerges within that specific organization during the unionizing effort.

As a third example (Study C), we might study how the knowledge exchange relations among employees within and across organizations impacts a person's promotion chances. While the knowledge exchange is dyadic, we ultimately wish to know whether the individual's position in the network (e.g., their degree centrality or brokering of structural holes) leads to the individual's promotion. The scope of the research could involve examining employees in a single organization with regard to their internal vs. external knowledge exchange ties, which might involve a random sample of employees from the organization, if the organization is large.

Table 1
Three fictitious examples of network studies that vary in target sample ("dyads of interest"), in scope and generalizability, and in level of analysis.

	Study A	Study B	Study C
Research question	Do teams with greater expertise diversity have higher team performance? And is this relationship mediated by the level of task conflict?	Does attitudinal similarity on unionizing between employees across departments (inside an organization) generate trust?	Does knowledge exchange among employees within and across organizations impact a person's promotion chances?
Dyads of interest	Intra-team relations (task conflict)	Inter-departmental relations (trust)	Intra- and inter-organizational ties (knowledge exchange)
Generalizability / scope	Across multiple organizations	Inside a specific organization	Single, specific organization
Level of analysis	Group level (density for task conflict)	Dyadic level (presence or absence of a trust tie)	Nodal level (degree centrality and structural holes for knowledge exchange network)
Sample	Multiple teams across multiple organizations	All dyads in an organization (or sample of dyads if large organization)	All individuals inside an organization (or sample of individuals if large organization)

2.2. Negotiating access to organizations

Once your research objectives are defined, you need to shop for partner organizations willing to assist in your research effort. Engaging with an organization to collect social network data is an opportunity to be an organization development-style researcher who engages in the various stages of collaborating with organizations, from scouting for potential partners, negotiating entry, collecting preliminary data for diagnosis, collecting additional data for planning, then helping top managers decide on organizational change action, as well as follow-up evaluation, and ultimately terminating the relationship with the organization (Kolb and Frohman, 1970). An important initial step in any data collection is developing a good strategy to approach organizations for entry as a research partner. There are *three main sets of stakeholders* whose needs must be met and balanced when attempting to negotiate access to organizations: 1) the organization's top management, who often have an organizational problem they are seeking to better understand and solve; 2) the lower-level employees, who need to agree to participate in the study to ensure its accuracy and success, and who should be given an active role in developing solutions, but who also need to be assured confidentiality and protected from any information that could potentially damage their career or health from being released; and 3) the research team, who have their scientific objectives and must keep an eye towards eventual publication and dissemination of the work.

2.2.1. Management perspective

Without prior social connections, gaining access to organizations can be difficult unless a *clear benefit* for the organization can be identified and articulated, a benefit that is preferably not offered already internally or by existing consultants. Our experience is that attempting to "sell" social network analysis to top management can be very difficult because it is not a simple concept to convey in a short, verbal "elevator pitch" and often requires graphics and long discussions to explain. Instead, we often approach top management with a question as to what "keeps them up at night" with regard to the internal functioning of their organization. They might respond that they are particularly concerned with issues such as excessive employee turnover or the organization's inability to innovate quickly; this then creates an opening to pitch the advantage of working with researchers who can offer scientifically rigorous advice in exchange for research access. It also allows you to consider whether your research objectives fit well with management's concerns. If you are in a situation where you do not need to make money from the research engagement, you can go as far as offering free or very low cost consulting in exchange for research access. In situations where you need to bring in money to your university, you can either attempt to compete with external consultants using the approach of trying to sell greater scientific rigor than what consultants provide. A different approach is to convince management to set up a collaboration between the research team and the existing consultants that they might be using currently. We have acted as subcontractors to consultants and this has allowed us to collect data, provide insights to the consultants, and then the consultants have been involved more directly in change implementation. In the process of creating a custom, data-driven solution for the organization, social network analysis can be introduced as a natural tool to help understand and solve such organizational problems as turnover or slow innovation.

Selling SNA within this problem-focused context is not as difficult as attempting it from a cold call – once a research and consulting relationship has been established, you should show top managers how SNA can provide unique insight into the organization's informal working, its shortcomings, and hidden problems. For example, you might identify a problem of conflict or distrust in a department (Marineau, 2017; Marineau et al., 2018). It might also reveal a lack of communication and collaboration between departments (e.g., Joshi et al., 2002). Illustrating how SNA has been used in prior studies (either your own or others') helps management envision how the tool can be used to address existing problems.

We continue to refer to "top managers" throughout this section because it is critical to get top management approval for the study prior to getting too far into the study design. Researchers often attempt to enter into a relationship with an organization through social contacts at lower managerial levels. Even if you have a fairly high-level middle manager willing to sponsor the research, our experience suggests that a top management champion for the research project (preferably a C-suite executive) is necessary in order to ensure a successful project due to the potentially invasive and controversial nature of social network research in organizations. Without that high-level backing, middle managers will often find that the social network aspect of the research will be questioned within the organization by lower-level employees and other peers, and higher-level managers will feel pressured to shut down the project if they have not been involved in its design from the beginning. On the other hand, if everyone recognizes that there is a top managerial champion for the project, there is a better understanding that the organization is willing to make a commitment of time and resources to conduct the research. This will assist middle managers in promoting and implementing the survey throughout the organization. There are also practical reasons for having a high-level sponsor: If you are gathering sociometric survey data, you might need to get respondents time off from work to take the survey or get email lists to send web-based surveys to all employees, which might require commitment from HR, IT, and other organizational members. Gaining top management's commitment to the project is thus crucial for its ultimate success.

One of the best ways to ensure top management commitment is to engage them in collaboratively developing the study with the research team. This is essentially a negotiation on what, precisely, will take place. As with any organization development project, the better specified is the research contract between the organization and the researcher, the better the outcome. Top managers must weigh the potential benefits of engaging in the study relative to the costs of involving their organization in the research, including employee time to participate, whether the research could create backlash or upheaval among the participants, whether the revelations from the study might ignite conflict within the organization, and whether other strategic priorities might need more immediate attention.

Negotiating what concepts will be studied and survey questions administered, and what resources and data will be made available to the research team from the organization (e.g., support staff, email data, archival HR data) should involve the top management champion. Unless the individual has a research background, they will often not recognize the importance to research-based consulting of having such long, scientifically-sound survey scales administered to a very high percentage of the employees, as they are often more familiar with practitioner-oriented work involving questionable reliability and validity that is done in a "quick and dirty" manner. You might be asked by management to include some concepts or questions that are applied or for which the underlying scientific basis could be questioned and which are not part of your research agenda, but that have been used by the organization in the past (e.g., using a Net Promoter Score as a way of measuring organizational attachment or employee performance; Reichheld, 2003; Aguinis and Burgi-Tian, 2021). By negotiating the inclusion of such scales alongside more scientifically-rigorous scales appropriate for your research program, you can often gain more solid organizational support for your project, as well as potentially gain their financial support for the project and analysis, if this is a requirement at your academic institution. Over time, you can assist the organization in transitioning from consultant-driven concepts to the use of more evidence-based measures and methods of enhancing organizational development.

While maintaining some flexibility toward these consultant-driven constructs, it remains critical to negotiate as much access to data as necessary to be able to publish in a top-level academic journal article up front, and to include this as part of the research contract. You will find that, on occasion, these contracts can be very detailed, with management being unwilling to use certain words (e.g., not allowing data on

interpersonal "conflict" to be collected), but showing a greater willingness to use other words (e.g., allowing data collection on interpersonal "adversaries"). One needs to weigh the scientific consequences of these decisions prior to agreeing to move forward with the project. If these types of changes would make the work ultimately unpublishable because it is not comparable with prior research, it is often better for the research team to decide not to pursue this further and instead find a new site, as compared to getting far along the process and finding out later that management has changed its mind about what can't be asked in a critical portion of the study. Even so, researchers need to recognize that organizations are operating in more turbulent and fast-paced environments as compared to universities and changes are likely to happen to the research, even at the last minute; so long as these changes are to non-critical, deal-breaking aspects of the work, flexibility is encouraged throughout the project. Having a Plan B throughout the research process is important.

There is also a need to negotiate how the data that are collected will be revealed to various parties, including top management, lower-level employees, as well as to external parties, including journal outlets, prior to commencing the project (see Borgatti and Molina, 2005; Cronin et al., 2020). Top management often expects that individuals' names might be revealed so that they can understand better who occupies a particular position in the structure. For example, they might wish to know who occupies a bottleneck position in the workflow network (e.g., a node with high flow betweenness centrality). Organizations are increasingly aware that products exist that allow their internal HR analysts to, for example, mine their company's email system to identify specific individuals occupying network positions of interest (which is legal in the U.S., but can be more problematic in other countries).

However, the situation is very different when using surveys to obtain network data, as the aim will be to maximize the study's response rate and ensure truthful answers, a situation one might need to clarify to management. First of all, the researcher needs to clearly state the aims of the study and survey to the participant, and in doing so also clarify how the information provided in the survey will be reported. Following this, consent is required from participants, and since network data are collected about relations with others, one might also need to get consent from those reported about in certain legal jurisdictions. The latter might be less problematic if these network questions ask about one's perceptions or attitudes about others rather than involving reports of their actual behavior. Hence, special care is needed concerning the legal aspects regarding privacy.

In general, one needs to be extremely careful about the consequences of information being revealed to management or others, as it can have unexpected consequences on whether and how survey participants respond. For a network study to be successful, the researcher needs to ensure high response rates; knowing that individuals' names might be revealed can dampen response rates. Even if employees consent to participate, their responses might be subject to greater social desirability bias, resulting in data that might be both less scientifically valid as well as useful for the organization's purposes. Especially in situations where there is an agreement in place to reveal responses about individual employees, other employees could exaggerate, for example, about having more contact with someone they are required to work with, even though they might actually have limited communication with them, or might fail to report a conflict that exists so that it doesn't somehow come back to haunt them later. Given all these drawbacks (among others not mentioned) to revealing names, it is generally important to convince the organization that important, actionable information can be gleaned without revealing names and steer clear of this practice whenever possible. It is important to show top managers and lower-level employees at the project's beginning that although no one outside the research team will see any names attached to network diagrams, the overall pattern of ties can be used to identify whether bottlenecks exist in particular departments or whether in certain cross-functional process flows in the organization (e.g., new product development) a restructuring is advisable in order to expedite or improve the organization's workflow.

Management might also be wary about how the results are shared with external parties, including scientific journals and social media outlets. Decisions on how to avoid revealing the organization's name and/or business sector should be negotiated at project initiation. Management might also have concerns about having researchers reveal the company's unique practices, whether good (e.g., process improvements) or bad (e.g., strategic vulnerabilities) which can be used by competitors to harm it in the marketplace. Generally, researchers are asked to sign non-disclosure agreements (NDAs) with the organization covering all of these issues; we advise involving your university's and the organization's legal counsel to modify the often-standardized NDAs to fit the particular research situation prior to signing these agreements.

Our experience as well is that top managers are conditioned by their interactions with consulting firms to request benchmarking data for their organization against similar organizations (e.g., "what is the typical density in an organization like ours?"). At this point in our field's development, there is often no way to provide meaningful benchmarking information about social networks across organizations, which can create a challenge in selling the utility of these network analyses. The challenge is to explain that the analyses help the organization to measure its own progress over the change process, rather than serving as an external benchmarking exercise, and that these analyses are very much dependent on the specific way in which work is organized and the organization's specific context. Making certain that this is understood during project initiation and potentially including other measures which might have benchmarks (e.g., Gallup's Q12 Employee Engagement Survey; Crabtree, 2005) helps to arm the project champion with the best way to explain the project to potential resistors throughout the organization.

All of these above issues should be included in a signed, written research contract that is agreed on by the top management and by the researchers (Kolb and Frohman, 1970). This contract reduces the risk that the project will be halted at some later point, after the researchers have expended great effort in developing the work.

2.2.2. *Employees*

Once top management has signed off on the research projects, the researchers must turn to getting employees at lower levels of the organization, including middle managers, to buy into the study and its goals in order to ensure high response rates and to minimize resistance to the research. If the researchers employ an organization development perspective that draws in the employees as partners in the research, the chances for its success increase greatly (Greenwood et al., 1993). Employees might view this study as an opportunity to surface existing problems, grievances, as well as potentially untapped opportunities for improvement, often because the researcher is seen as a neutral third party who might be able to help them improve their well-being and productivity. This places the researcher as a broker between lower-level employees and top management, and the researcher should treat this as an opportunity to collect preliminary data via interviews and to potentially amend the research contract ahead of more comprehensive data collection. However, it is also important to set appropriate expectations of what the limits will be for the research project so as not to have the employees argue later that more was promised by the researchers than was delivered.

In every communication with the employees, it is critical to be clear about what will be collected and how those data will be treated. As discussed above, it is generally advisable to ensure and clarify that identifiable data will not be used in the feedback in order to avoid non-response and biased responses. However, employees might still be wary, and it is helpful to show employees previous network studies and explain how the data are aggregated, and point out that groups of fewer than five people are not broken out in analyses, but are rather lumped into a "miscellaneous" category. We might also show them how previous

network analyses were used in other organizations to affect organizational change so that they understand what the possibilities might be.

A major fear that is often evoked is that the social network analysis will reveal that certain aspects of the network are redundant or replaceable, and that this will result in downsizing (also referred to as "redundancies" or "layoffs"). Similarly, others fear that the results might be associated with particular individuals and have an impact on their performance appraisals, as well as subsequent salary growth and promotion within the organizational hierarchy. These are all reasonable assumptions, particularly as we see some organizations beginning to use SNA for precisely these purposes (e.g., Arena, 2018). We find that an explicit, written and verbal commitment from top management that is published openly to the organization stating that the SNA results will not be used for evaluative purposes, but rather for developmental purposes, helps to make the project more successful. In particular, making a commitment that even if there is a reorganization, everyone will find a new role is one that allays the greatest employee fears related to these projects, and might even enhance participation as employees might see this as an opportunity to contribute to improving the newly-restructuring organization.

One significant difference between this type of action research based in organizational development and purely functionalist research that strives not to get involved with the organization is that the researcher shows the employees the survey items and describes any archival or electronic data they are being provided by the organization prior to asking for informed consent. By giving the employee the full view of the study and then allowing them to ask as many questions as they would like, and answering those questions honestly and in a detailed manner, employees develop trust with the research team and are willing to provide response rates of 80–100 % (which we have achieved in previous research). While other research paradigms rooted in a functionalist perspective might view this as anathema because it "primes the subject" to know the true purpose for the study, thus potentially biasing their responses, an organizational development research perspective views this as a crucial piece of working with the subjects to make the project and any subsequent organizational change successful in improving organizational functioning.

Employees that are being introduced to social network analysis for the first time will often find the possibilities intriguing and might be interested in the results, particularly with regard to how they are positioned inside the informal organization. Researchers will often offer to provide individual feedback to employees that compare their responses to psychometric survey constructs as well as their network position and characteristics relative to others in a packet for employees to use in their continuing professional development. This can be insightful and fun, but it can also be challenging for some employees (e.g., if they are peripheral to the network); thus, we always offer to speak with the employee about their results in a confidential one-on-one session. Such a conversation might also provide new and unexpected insights to the researcher. *A priori* clarity on what will and will not be revealed to employees and top management is, thus, an important aspect of recruiting participants. We will speak more about how to recruit participants in the section on social network data collection labs.

2.2.3. The researcher

As you attempt to satisfy top management and lower-level employee requests on how to conduct your research while negotiating entry, it might become tempting to give in to all of their requests in order to secure their collaboration. However, it is vital to remember that this remains a negotiation and if you are unable to get what you need to be able to ultimately conduct a rigorous study and publish it in a top outlet for your work, the immense effort will have been wasted. We have found that for some projects, carving out separate research and practitioner portions of the survey serves as a reminder to top management that there is a *quid pro quo* at work in the survey. If they continue to attempt to cut or influence the research portion of the study too much, the researcher must exercise their ultimate move in the negotiation, which is to walk away from the organization and begin scouting for a new one. While there might have been significant investment of time and resources in finding the potential partner with whom you have been negotiating entry, that investment should be viewed as a sunk cost and not factor into whether to continue forward with the project; ultimately devoting increasing time and resources into a project that is unpublishable does not serve your purposes and must be avoided at all costs.

This negotiating entry element of a successful project should end with a clear top management champion for the project, a clear delineation of the research contract and a non-disclosure agreement, which have been signed by you and the organization's top management, and a detailed enough survey instrument that can be submitted for approval to your university's ethical research review board (e.g., the Institutional Review Board in the U.S.). Some lower-level employees should already know about the project and be willing to vouch for your trustworthiness in maintaining confidentiality and for the project's relevance for improving organizational functioning. Every project will encounter significant resistance from organizational members, including other top managers and lower-level employees; we will detail some approaches to minimizing that resistance, and instead maximize participation through survey data collection techniques in Section 2.4.3.

2.3. Identifying network boundaries, formal structures in the organization, and sampling

One of the elements that distinguishes work organizations from many other foci of social activity, such as football club supporter groups or school classes, is that they have more well-defined formal structures with clearly delineated and differentiated but interdependent roles that assist in goal achievement, often with multiple layers of units such as teams and departments. These properties need to be identified and accounted for in order to proceed with a valid and useful social network analysis.

2.3.1. The network boundary

Once it is decided whether you want to study the network relations within and/or between organizations, departments, or teams, identifying the boundaries of the group(s) is crucial, and this can be a difficult process even in concept, yet it is an important aspect of proper research design (Laumann et al., 1983; Marsden, 1990). Which individuals should be captured in the social network analysis, must be evaluated early in the study, and this boundary specification problem must be addressed with an eye toward answering the main research question (see Section 2.1). Even in situations where there is an easily-observed, legally-recognized boundary to the work organization, delineating who is an employee and who is not, questions about whether part-time employees or long-term external contractors should be included in the SNA abound. Our general rule-of-thumb is to rely primarily on the top managers' and the employees' evaluations of whether a certain type of employee is important enough to the organization's functioning to include in a network analysis. For example, in one company we studied, all of the new product development was handled internally by full-time employees, while in another company, new product development involved a community of external inventors who freelanced and, while not formal employees on the company payroll, were considered vetted long-term partners. If we are conducting a study on networks and innovation, excluding these external inventors from the network would not provide the full picture needed to answer our research question. We have encountered these types of boundary specification issues without regard to whether we are conducting a survey-based (should we include the person on a roster as a potential alter?) or email-based network analysis (should we include emails to and from this person?), because the ultimate question of who is a member of the group(s) or sub-group(s) of interest is difficult to answer definitively and must always be considered within the context of the research question being asked.

Practically speaking, even after making a decision such as including all full-time, paid employees in the research, it might be difficult to pull off the study. In many medium-sized organizations, for example, the human resource (HR) function might not have an accurate and updated list of all employees; this is particularly true in organizations that experience high levels of employee turnover, such as retail firms. Payroll is also increasingly handled by external firms to whom the function has been outsourced and getting an accurate employee roster can take some time and effort. At this stage it is important to get the direct supervisors and managers of those you want to study involved, to check the accuracy of the available information. For example, if one is conducting an analysis of email networks alongside the surveyed networks, it is very likely that each employee will have numerous email addresses associated with them (e.g., email addresses under maiden names, legacy email addresses from old systems), and determining a unique set of addresses takes substantial effort (Woehler et al., 2021b) which need to be corroborated by organizational management.

These questions also occur when considering structural boundaries within the organization. For example, a network analyst might wish to conduct a study on intra- and inter-team networks. But specifying who is a member of a team (or multiple teams) is often a difficult task, and one that the organization's HR department might not be adequately expert enough to assist in making determinations.

2.3.2. Formal structure

The other feature that often distinguishes work organizations from other looser forms of human groups is the existence of a formal structure (Cross et al., 2002; Hollenbeck et al., 2012 for teams). We will define formal structure here as any type of exchange or interaction that is organizationally imposed on employees to facilitate goal achievement or behavioral monitoring. Formal structure must be accounted for in intra-organizational social network analyses because it is often theoretically important to distinguish relationships, interactions, and flows that are purely voluntary from those that are mandated by the organization (e.g., Soltis et al., 2013); for example, interpersonal conflict between two employees might result in avoidance behaviors in a voluntary relationship as compared to overt manifest conflict behaviors in an organizationally-mandated relationship.

One aspect of formal structure is *horizontal differentiation*, where individuals are placed into different groups to facilitate the achievement of sub-goals that contribute to organizational functioning. These groups or teams can have varying levels of formality, from departments and divisions to loosely-configured project teams (Hollenbeck et al., 2012). It is often challenging to determine which individuals belong to each of these groups, and it is unlikely that the HR function will have an accurate picture of this. This is exacerbated in organizations where employees are members of multiple groups; for example, organizations based around project teams often have employees working on multiple teams, and their team membership is fluid. This challenges the researcher to get an accurate picture of current membership, as well as decide whether and how to include past team members, and how far back in time to go when including members who have moved on; one might instead involve the direct team leaders to get a more accurate membership roster or to collect additional information about the formal structure in the survey.

Horizontal differentiation leads to each group being focused on its own sub-goals and thus creates the need for *interunit coordination* to harmonize these sub-goals in pursuit of the organization's overall goals. Thus, the routines and processes that are developed to facilitate these interunit exchanges are another aspect of formal structure that must often be accounted for in SNA. Organizations accomplish this interunit coordination in myriad ways, but one common approach is to set up a formal interunit process, such as new product development, that is led by an individual that draws together employees that are formal members of different units (e.g., engineering, marketing, manufacturing, logistics). This interunit coordination can occur in an ad hoc one-time team or can be institutionalized into a recurring process. If one's interest is to study intra- and inter-team social networks, for example, merely capturing membership in formal departments would not adequately catalogue the mandated interaction that is imposed cross-functionally by the formal new product development process. There is often also a *dependence* structure to work roles that has been imposed through differentiation (e.g., de Jong et al., 2007). An employee in a particular role might not be able to move forward with their work until they receive inputs from another, or they might be directed to send their outputs to specific alters; without surfacing this dependence structure, particular relationships might be robbed of their organizational context. This would be especially detrimental in any studies relying on understanding power dynamics in organizations as these dependence structures would be a major determinant of an employee's ability to get someone to do something they otherwise would not do.

Another aspect of formal structure that should be accounted for is *vertical differentiation*, where a chain-of-command is imposed to monitor and direct employee behavior toward goal achievement. We often recognize that the relationship between an employee and their manager is critical to performance and well-being, but even identifying an employee's formal leader can be challenging. Certain formal structures such as matrix organizations intentionally create situations where each individual has at least two formal managers (e.g., a functional department manager and a product manager) and many knowledge-based organizations such as information technology consulting firms can have complex four-way matrix structures with each employee having numerous managers (Galbraith, 2009). Attempting to take a network perspective on topics such as leader-member exchange in such settings would be extremely complicated by the cross-cutting nature of these reporting relationships. Even in the situation where there is unity of command and the person only answers to one manager, there is often the issue that the employee's direct manager in turn reports to a higher-level manager and the degree to which one's direct manager has been delegated the autonomy to direct, monitor, and appraise subordinates can differ drastically across organizations. Such formal structural aspects might have important consequences on the structure of both formal and informal social interactions, and need to be taken into account when comparing network structures across organizations.

2.3.3. Population or sampling-based data collection approaches

The chosen research question will often dictate whether there is a need to collect data from the entire population of individuals (i.e., conduct a whole network analysis) or whether it is possible to approach data collection through one of the four common types of network sampling (Fig. 1), or to use some combination of the approaches (cf. Marsden, 1990; Agneessens, 2021). For example, if one's research question is whether an employee's closeness centrality in the friendship network determines their innovativeness over time (a nodal level question), and data will be collected in a single organization (specific scope), the network analysis will most likely involve examining an entire population through a whole network approach. Because closeness centrality is a concept that relies on understanding how far away alters are on average from each ego in the network, a more global type of data collection is warranted. On the other hand, if one's research question is whether an employee's level of network constraint is related to their innovativeness (another nodal level question, but much more localized around ego and their immediate alters), one might wish to collect data using ego network sampling across a lot of different networks in order to establish that the relationship between the constructs is generalizable outside of a single firm. Thus, matching the research question to one of the five different approaches to data collection detailed below is important.

2.3.3.1. Population. Conducting a whole (complete) network analysis involves eliciting the relationships among each of the individuals within

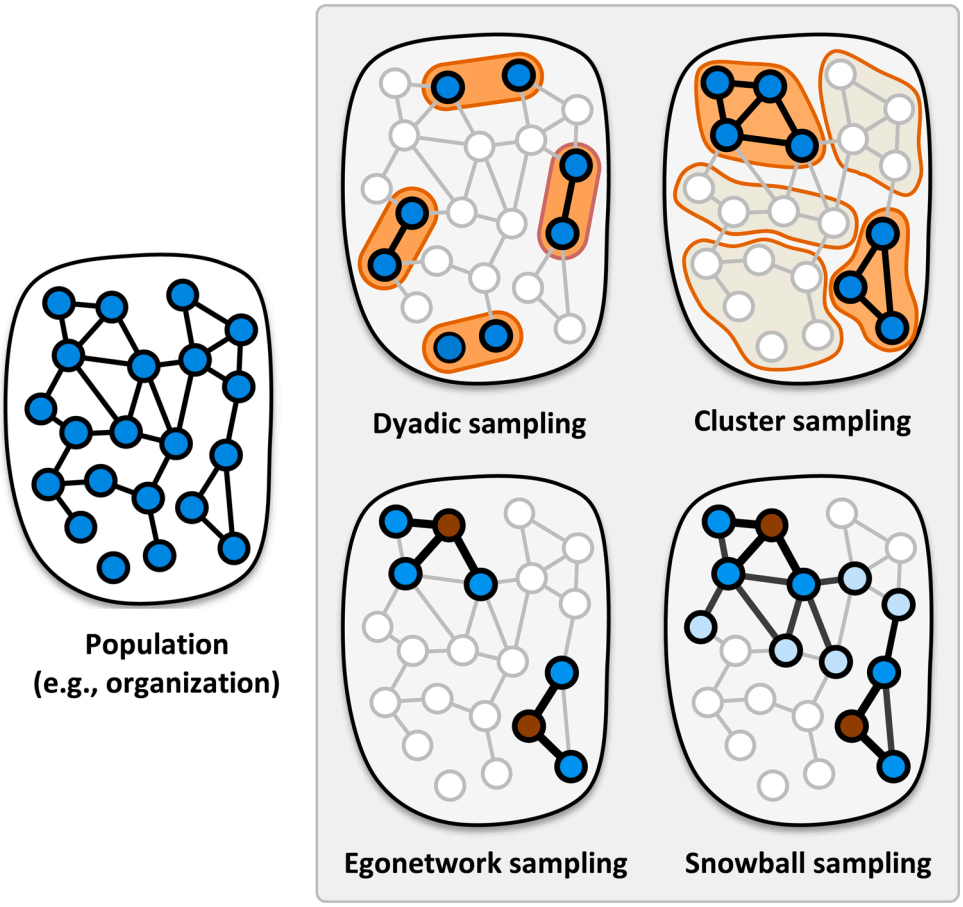

Fig. 1. Illustrations of whole population (complete network), dyadic sampling, ego-network sampling, snowball sampling, and cluster sampling approaches to data collection.

an entire network. We tend to see this approach used when the research question involves, for example, more global measures of position such as betweenness centrality (Brass, 1984; Mehra et al., 2001), or where we are attempting to describe an entire network (e.g., centralization) (Kane and Labianca, 2011). It is very attractive as a data collection approach because full information is available, thus maximizing the conclusions one can draw through network analysis. However, it can be a very time- and resource-intensive process, and thus might not fit one's research question well if, for example, one is attempting to accomplish a study that is generalizable across a wide selection of organizations or where more local measures (such as degree centrality or ego network density) are theoretically significant. Thus, we might decide to employ one of the four sampling techniques detailed below.

2.3.3.2. Dyadic sampling. The most "extreme" version of sampling is to randomly sample dyads in an organization. We might see this type of dyadic sampling when we are interested in research questions such as whether a dyad's relationship is stronger when the two individuals both strongly express the same trait (e.g., both are extroverts), or when they are complementary on that trait (e.g., one is an extrovert and the other is an introvert). The strength of this approach is that it can be conducted over a wide variety of organizations in an attempt to make a more generalizable statement about the importance of trait similarity or complementarity (e.g., Kenny et al., 2006). Such an approach might be particularly useful when dealing with a large organization, and where we might, for example, want to study inter-departmental trust ties (cf. Study B in Section 2.1.4). However, while this approach might seem the closest equivalent to the type of random sampling done on individuals in typical psychometric studies, it ignores the issue that network data are inherently interdependent. Since "neighboring" dyads are not independent of each other (e.g., an extrovert-extrovert dyad might attract very different partners into triads as compared to an introvert-extrovert dyad), no information about the surrounding structure is available, and that might affect the particular dyad's relationship strength (Goodreau et al., 2009). For most social network research questions, the surrounding structure will be important to capture theoretically, thus meaning that a different sampling technique should be employed.

2.3.3.3. Ego-network sampling. A second approach is to randomly sample individuals (egos) and then ask these selected employees about their relations with all the employees to whom they are tied directly (alters) (Perry et al., 2018). One can also ask each ego to provide their (potentially biased) perspective on alter-alter ties, as is done typically in research on structural holes (DeJordy and Halgin, 2008; Burt, 1984). This generates a full picture of the network immediately surrounding ego, and therefore might be helpful when conducting analyses at the nodal level (e.g., using local measures such as degree centrality or constraint) and especially when attempting to capture both intra- and inter-organizational ties (as in Study C in Section 2.1.4). Two examples of this approach include studying whether extraverts have more open ego network structures (Kalish and Robins, 2006), and examining whether employees who occupy a structural hole position get promoted faster (Burt et al., 2000). However, this approach has the disadvantage of not including the alters' perspective on the network. Moreover, nothing is known about connections two or three steps away, thus not allowing more global measures to be examined (e.g., betweenness or closeness centrality), which might miss important aspects of the network influencing attitudes, behaviors, or outcomes.

2.3.3.4. Snowball sampling. One extension of an ego-network approach is to identify a core individual, ask about his or her alters, then contact those alters and ask about their connections (which could include ego), and then continue to move out from there further into the network (Goodman, 1961). The result is a snowball approach where the network connections two or even three steps away are obtained (see for example Snijders, 1992; Frank and Snijders, 1994). Outside of the organizational sciences, we have seen this type of snowball sampling used when examining, for example, heroin use networks centered around a certain location such as a park or community or to estimate crimes by offenders and the co-offending (e.g.,Frank and Snijders, 1994; Doreian and Woodard, 1992; Weeks et al., 2002). Within organizations, it is rarely used, though it can be helpful when examining, for example, loosely-configured groups with no formal structure or rosters of membership, such as communities of practice (e.g., researchers interested in machine learning) or identity-validating groups (e.g., a minority employee networking group or a drug addiction support group). However, this sampling approach's effectiveness depends heavily on selecting the best set of initial egos around which to snowball sample (Gile and Handcock, 2010; Weeks et al., 2002). It can also complicate statistical analyses because the alters and alters' alters are not being chosen at random (see, for example, Pattison et al., 2013; Stivala et al., 2016).

2.3.3.5. Cluster sampling. The fourth sampling approach involves identifying all of the subgroups in an organization *a priori* (e.g., all departments, units, project teams), randomly sampling those subgroups, and then collecting whole network data from within each of those sampled subgroups. One example of a research question where this might be useful is where we wish to compare the level of *tertius iungens* behavior in engineering-oriented organizations vs. finance-oriented organizations; here we might wish to understand whether the ethos in these types of organizations affects the extent to which individuals help to bring together disconnected others, versus keeping them apart in order to benefit from their disconnection. By finding a large number of engineering and finance organizations willing to participate in the study, then randomly sampling some subgroups, and finally collecting whole network data within those subgroups, we can compare these different types of networking behavioral orientations in different organizational cultural contexts. This approach has the benefit of allowing these networking behaviors to be examined beyond the dyad or triad, and include all of the social structure within the subgroup. However, this approach assumes that the only social structure that matters occurs within the subgroup; any ties external to the subgroup that might be influencing networking behavior within the group are opaque to the researcher. Extending this, we might take a random sample of organizations and within each of the sampled organizations then randomly sample teams where we collect intra-team data (cf. Study A in 2.1.4).

2.4. Collecting network data and approaching organizational members

A third element centres around building the appropriate survey questions and approaching employees. We will first discuss how to identify the appropriate network question(s), followed by more specific issues regarding building these question(s), including phrasing, choice of answer categories, and how to generate the names of alters. We will then discuss strategies for approaching the respondents in order to minimize non-response.

2.4.1. Generating network data through a survey

Survey-based network research involves collecting social network data from organizational members. When collecting ego-network data, we are soliciting from (a sample of) organizational members the names of colleagues with whom they have a specific type of relationship (e.g., "with whom did you communicate within the past month?"), i.e. we employ a *name generator* question in order to define their ego-network. This is then followed by additional questions about the characteristics of their specific relationship with these alters (e.g., "How frequently did you speak with this person?") and, at times, their perceptions of those others' alter-alter ties (e.g., "How frequently do Alter A and Alter B speak with each other?"; cf. Burt, 1984). This name-generator approach can also be used to collect complete network data, although a *roster* approach (which lists all the names of alters in a group) is more typically employed in that instance. The collected answers from each respondent are then assemble into a broader, collective social network (cf. Fig. 1). Name generators are especially useful if the group is relatively small (e.g., to study intra-team relations) and/or if the network is relatively sparse.

For either a name-generator or roster approach, selecting and wording network question(s) properly to be able to test your research question(s) is crucial. Following Borgatti et al. (2009), network relations can be classified broadly into 5 major types, depending on whether the aim is: 1) to obtain information about specific interpersonal interactions and/or the flows that took place between employees; 2) to elicit cognitive perceptions from ego about the other person; 3) to capture the affective response that a colleague generates; 4) to identify the broader social (role) relation two employees occupy; or 5) to focus on employees' similarities. Table 2 provides examples of some of the common types of network relations asked in organizational settings organized according to these five types, which we discuss in more detail below.

2.4.1.1. Interactions and flows. In many cases, we are interested in the interactions that occur within the workplace. These might involve communication and the transmission (or non-transmission) of information and other resources. Common behavioral interactions at work include seeking advice, collaborating, helping, supporting, communicating, providing feedback, commenting on others, and helpful gossiping. We might also focus on more destructive or negative behavior, such as hindering someone in their work, providing misinformation, bullying, undermining, or simply avoiding them. In addition to behavior at work we might focus on interactions outside work, such as socialising outside

Table 2
Examples of positive/neutral and negative types of ties organized by type of network (based on Borgatti et al., 2009, and Podolny and Baron, 1997).

	Positive	Negative
Interactions and flows[a]	Collaborate	Hinder
	Share advice	Lie to
	Communicate	Provide misinformation
	Influence	Avoid
	Positively gossip about	Undermine
	Socialize with outside work	Negatively gossip about
	Task conflict	Bully
Cognitive evaluations/ perceptions of others	Consider someone an expert	Consider someone incompetent
	Consider someone influential	Distrust
	Trust	
Affective response	Like	Dislike
	Feel energized by	Envy
Social (role) relations		
Instrumental and position	Required to work with	Rival
	Subordinate to	Competitor
	Supervisor of	
Identity and position	Formal "buddy" or mentor	Required buy-in from
Instrumental and individual	Protege	Devil's advocate
Identity and individual	Consider a friend or ally	Consider an adversary
Similarity-based ties	*Attend the same meeting(s)*	*Attend different meeting (s)*
	Went to the same university	*Went to a competing university*

[a] Includes recording specific interactions.

work and/or spending time together.

Although specific instances of helpful or harmful behavior could in principle be measured directly, in survey-based approaches we generally will ask about aggregated levels of interaction within a specific timespan (such as, "How frequently did you speak with A over the past week?"). In fact, we can think of the interactions being discussed above as aggregating a series of relational events or interactions where exchanges are taking place. Hence, information about interactions can also be gathered by examining specific flows occurring between two actors directly. While we focus in this paper on collecting data on social interactions through surveys or structured interviews, these can be complemented with other sources of information. Especially, with the growing prevalence of social network analyses of digital trace data, such as email, it is increasingly popular to study the discrete interactions among individuals more directly. For example, if we collect the emails that are being sent from one employee to another, we can analyze these interactions using relational event models (Butts and Marcum, 2017; Vu et al., 2015; Lerner and Lomi, 2020; Stadtfeld and Block, 2017).

We might also focus on the exact content being transmitted and/or on the style of transmission. The focus is then on what is actually being exchanged during interactions or events between actors, i.e. the content of specific flows. Network theories often imply that flows are taking place between individuals, including flows of money, information, referrals, advice, help, and gossip (or misinformation, negative gossip, and harm). However, there have been few attempts in organizational settings to study these flows directly. Some flows, such as money, move unchanged from one node to the next in the network, while other flows, including stories and gossip, might be more malleable, with certain aspects of the flow being changed, added to, or subtracted from as exchanges occur (cf. Borgatti, 2005). While it is possible to study network flows using survey methods (e.g., asking survey respondents to maintain diaries noting each instance when a particular flow of interest, such as political support, is provided by an alter), flows are generally easier to study using either archival records or digital trace data where the flows can be more easily observed and measured directly.

Digital trace data has made it increasingly possible to study actual flows through networks, rather than merely inferring them. For example, we could study how specific email information might spread through a network, or we could take a specific word or article that is new to the organization and watch it propagate (and perhaps change) as it moves from individual to individual (or whether misinformation is being spread through a network). Digital trace data might also focus on repositories of information that are being used by employees (e.g., Gonçalves et al., 2017). If we are interested in project work and understanding each member's contribution, we might study where information on projects are shared and adjusted in common folders and track what information is contributed and retrieved by whom in the team repository (c.f., Lerner and Lomi, 2020). Alternatively, if we are interested in offline interactions among employees, we can employ sociometric badges (or other recording devices) to capture the interactions. This could allow us to, for example, transcribe the conversations to analyze the words being transferred or measure the voice pitch, movement, or interruptions in an attempt to understand the implied hierarchy and status among two or more people (e.g., Koyrakh et al., 2008).

One advantage of such digital data is that it is generally seen as "objective," while the survey responses can be somewhat "subjective." Although researchers have debated whether people are accurate about recollecting actual behavior over a given timeframe (e.g., Bernard et al., 1981; Freeman et al., 1987), one reason for focusing on more subjective perceptions, rather than observational data, is that these perceptions actually matter (Richards, 1985; Marsden, 1990). The question therefore becomes whether one aims "to measure actually existing social relations, or social relations as perceived by actors involved in them, sometimes called 'cognitive' networks" (Marsden, 1990, 437).

2.4.1.2. Cognitive perceptions of others and others' ties. In addition to these interactions, we might also be interested in the perceptions and evaluations that an employee has of another employee, and in particular how one person evaluates work-related aspects of another person from a subjective, cognitive perspective. This could be very general, like asking about general levels of competence, or very specific, such as asking respondents about who they see as an expert on some topic or consider competent in some area (Kim and Glomb, 2014). For example, if we are interested in conducting research on transactive memory systems, we might wish to know if ego knows a particular alter, and whether they know what information that person has that might be relevant to ego's own goal achievement. Cognitive perceptions are not restricted to evaluating expertise in knowledge domains; we might also wish to study whether individuals evaluate others' behavior as trustworthy, for example. These types of cognitive evaluations (i.e., beliefs held by ego) are often of interest because of their potential impact on actual behavioral interaction.

Finally, we might also wish to know how ego perceives the network around them, as such (mis)perceptions might impact a person's strategy of interacting and building ties. For example, if ego believes a person is friends with her friend, she will be more positively inclined towards that person than if she believes that the third party is not her friend's friend. A particular type of research has focused on individuals' accuracy in perceiving the network around them (Krackhardt, 1990), which can be very important if they wish to activate those network ties for career or political purposes (Marineau et al., 2018). Each of these reported ties in the individual's cognitive social structure can be considered either an accurate, imagined, or missed tie in the network.

2.4.1.3. Affective response. A different type of tie involves how a person is related affectively to another person, i.e. what emotional reactions the other person triggers. These types of ties are generally relatively enduring, and seek to elicit the *typical* feelings that are evoked by one person about the other. Affective ties studied include liking and disliking (Umphress et al., 2003), feel comfortable with, or having ambivalent reactions (Methot et al., 2017), as well as some recent work on being energized or de-energized by others (Gerbasi et al., 2015). In addition to asking about general affect toward a person in the context of an enduring relationship, many of the same types of questions can be asked with regard to a specific interaction between ego and alter; for example, we can ask someone to consider their last interaction with an individual and then ask them to report what emotions they experienced during that relational event.

2.4.1.4. Social (role) relations. Social interactions, perceptions and affective feelings often take place within a broader embedded context, which involves characterizing the network relation between two people. We might define each other as friend, coworker, competitor, or adversary. Such roles are abstract and commonly defined by society, and they bring with them specific expectations and obligations with regards to social interactions (Nadel, 1957). For example, we can expect a certain level of emotional support from friends, and collaboration from team members. Hence, those relatively enduring role relationships are the basis for what can be considered as a (sometimes long) series of discrete behavioral interactions, as well as stable feelings about the person. Note that roles are more abstract and tend to bring together a variety of expectations with respect to specific interactions, as well as positive or negative emotions and cognitive evaluations.

There are many roles that can be captured in organizational network research, and one way to differentiate these is by relying on a popular two-dimensional typology proposed by Podolny and Baron (1997). Following this, we can identify roles base on the extent to which they: 1) tend to convey *instrumental resources* or involve conveying broader organizational *identity* content or normative expectations; and, 2) tend to be more *individual-to-individual* (i.e., informal and generally voluntary

and defined by those involved) or more *position-to-position* (i.e., formal and generally required and defined by the organization).

Those ties that are instrumental and position-based are very much based on the formal organizational structure and include being a co-worker with whom one has a required workflow tie (Soltis et al., 2013), and can be expected to lead to collaboration and knowledge sharing. Similarly, being a supervisor implies a "report to" tie, and can expect adhering to "orders." At the other extreme, network relations which are identity- and individual-based include friendship (Fischer, 1982) and the implied social support ties that can come with them (van der Poel, 1993).

Roles that tend to be more instrumental and individually-based include being a mentor or protégé. A senior person chooses to strategically help a person's career by conveying strategic information that can be useful to the more junior colleague as they strive to ascend the organizational ladder. Although these roles are primarily focused on instrumental resources being conveyed towards a specific person, Podolny and Baron do emphasize that such ties can bring with them more affect-based ties as well. They point out that their typology is not always clear cut when characterizing real-world relations, with some dyadic ties falling in multiple categories.

Finally, an example of a more organizational identity-based tie that is formally introduced by the organization occurs when an organization implements a "buddy system" to enable members to more quickly integrate into the organizational culture (rather than being focused specifically on training for their own job). Of course, again this can evolve into a true buddy or friendship over time, but in itself it ensures formal socialization and getting acquainted with organizational norms and informal rules.

2.4.1.5. Similarities. The final type of relational data in organizations are not actually interactional ties but dyadic similarities that either increase the possibility that ties exist or can be used to infer their existence. A fairly typical example of this is the use of shared membership in a group or attendance at a conference to infer that a tie exists. Employee *similarities* are often used to infer ties in the absence of actually collecting data on the relationships; for example, by obtaining data specifying that two employees are on the same team, researchers might use that membership similarity to infer that they are tied socially (we can also use dissimilarities to infer potential faultlines in networks). In the same way, membership on the same boards is often used to infer connections via interlocking directorates (Burt, 1980). We can see these as two-mode network data. An example of conducting this type of network data collection might be to approach the members of a very large, multinational consulting firm to ask them which internal conferences they attended over the past year, and then use those data to infer ties among the employees that can be used to predict various outcomes, including attitudinal changes. These types of similarities can also include spatio-temporal locations (e.g., being in the same manufacturing plant during the same daytime shift) or nodal attributes (e.g., being of the same race/gender, holding similar attitudes toward an organizational issue), all of which are used as proxies for ties. Archival data are used widely for this type of research (e.g., shared membership in groups and teams) often alongside survey data.

In conclusion, deciding which type of network question best fits with your research question means considering whether your theorizing relies on similarities, social relations, interactions, or flows, and then measuring these at the most appropriate level of specificity.

2.4.2. How to measure a chosen network relation

Developing network questions to measure a specific relation can be challenging and often involves numerous considerations (see also: Robins, 2015; adams, 2019). Some of the suggestions discussed here come from our own experience developing questions, while others draw on more general work involving questionnaire design (e.g., Presser et al., 2004; Tourangeau et al., 2000; Sudman and Bradburn, 1982; Saris and Gallhofer, 2014; Kalton and Schuman, 1982). To illustrate some of the core decisions that need to be addressed, we will primarily consider examples of questions that have been used to capture the "advice-giving" and "advice-seeking" relation between employees in an organizational context.

2.4.2.1. A single item vs. multiple questions. First, in most SNA studies only a single question is used to elicit the relations with alters. This is due in part to the time-consuming nature of responding to network questions, but also because a single question generally suffices to elicit specific behavior. The main argument is that different questions might not capture a common underlying relationship, but rather might represent different kinds of relationships which could exhibit different patterns (Laumann and Knoke, 1986; Marsden, 1990). In cases where multiple items or questions are used to measure a single network relation, this has often been done for other reasons as well. One common rationale is to use different questions to capture different aspects of a specific behavior. For example, Sparrowe et al. (2001) asked respondents two questions: "Do you go to (name) for help or advice on work-related matters?" and "Do you talk to (name) about confidential work-related matters?" to capture advice. They then calculated the maximum of both to get an idea of the overall level to which either of these behaviors are present. In some situation, where we are dealing with small teams (e.g., with an average of six members) and where there would be little respondent fatigue in answering multiple relational questions about all the other team members, we might instead consider collecting relational data with multiple items and then factor analyze these, or instead use multiple items of a Guttman scale (Friedkin, 1990).

2.4.2.2. Formulating the network question. To measure a specific relation, you need to decide whether to use a word that *directly names a construct* in the question explicitly (e.g., "with whom do you gossip?"), or whether to use a more indirect description (e.g., "with whom do you informally talk about absent colleagues in an evaluative way?"). Especially when a construct has a negative connotation (e.g., gossip), providing a description rather than explicitly naming it allows you to measure a gossip tie that might otherwise generate social desirability-biased responses (Ellwardt et al., 2012). There is also the decision of whether to opt for a *general* question or a more *detailed* question. Erdogan et al. (2015) provide an example of a general question to measure advice-seeking: "list the names of all coworkers you go to for work-related advice;" while Lazega (2001) has chosen to be more specific and provides examples of situations that represent the advice relation: "To whom did you go for basic professional advice? For instance, you want to make sure that you are handling a case right, making a proper decision, and you want to consult someone whose professional opinions are in general of great value to you. By advice I do not mean simply technical advice." In essence the more refined description approach delineates what is meant by (professional) advice and ensures question standardization, rather than leaving it to the respondents' subjective interpretation of the question. Hence, you might choose this more descriptive approach when dealing with constructs that might otherwise be interpreted very differently by various respondents, or that respondents might easily misunderstand (e.g., "Who provides you with psychological safety?"). Providing a more detailed description of the relationship you wish to capture not only has the advantages that the researcher knows more precisely to what construct the employee has responded, but also requires the respondent to slow down in answering the survey and reflect longer on a particular type of situation. In addition, if examples of specific behavior are provided, these might also function as recall aids, triggering specific instances in respondent's minds that they would otherwise forget when confronted with a more general question (Brewer, 2000).

However, these detailed descriptions imply that the researcher

imposes a specific interpretation on the concept, and sometimes you might be interested in the respondent's conception of, for example, friendship (Fischer, 1982). More generally, there is the issue of what defines a specific relation, such as advice, and what elements are aspects of advice and which are not. In a work context, it is important to specify whether you want to zoom in on work-related/professional advice (i.e., focus only on the social network focused on formal aspects of the organization), or also incorporate personal advice (i.e., to understand informal organizational behavior). For example, Sparrowe et al. (2001) used a broader approach for advice that included both helping and advice, as well as talking about confidential work-related matters, which might also bleed into the constructs of gossip and social support ("Do you go to (name) for help or advice on work-related matters?" and "Do you talk to (name) about confidential work-related matters?"). Others have disentangled advice further, with Cross, Borgatti & Parker (2001) having proposed five different dimensions of advice (providing solutions, meta-knowledge, problem reformulation, validation, and legitimation) instead of the general advice question. Be aware, however, that specifying a construct in this manner might not fit the employee's view of the construct and thereby bias the respondent to focus on some aspects of a relation as defined by the researcher and not on other aspects important to them.

2.4.2.3. Timeframe of behavior. Unlike affect or cognition, which tend to focus on present evaluations (e.g., liking, trust), asking employees to recall actual past behavior requires employing a realistic timeframe within which that behavior occurred and the recall will be valid (see Bernard et al., 1984 and Marsden, 1990 for the problem of information accuracy for retrospective data). For example, Lazega (2001) asked about advice exchange over the past year, while Cross et al. (2001) only over the past month. These timeframes need to match organizational realities (e.g., if an organization employs project groups that change every three months, a year-long timeframe might not be valid), i.e. neither too long or too short. Long timeframes, such as "How many times did you meet with Person A over the past last year?" could be influenced by recall bias as respondents might not recall specific events, a problem referred to as "recall loss" (Cannell and Kahn, 1968; Kalton and Schuman, 1982). Even, when they recall events accurately, respondents might also have problems remembering which events fell within the specified timeframe, and some research suggests that respondents tend to remember events as occurring more recently than they actually did, which is known as the "telescoping" error (Sudman and Bradburn, 1973; Bradburn and Sudman, 1974). On the other hand, employing too short a time frame risks capturing atypical behavioral events that introduce a lot of random noise into one's network analysis (e.g., being asked to work offsite for a special project) or missing important events that happen infrequently throughout the year (e.g., asking for buy-in from a senior manager on a project). Some researchers attempt to avoid this issue by referring to a less specific timeframe, and instead asking about, for example, "an average week." The difficulty with this approach is that if the interaction has changed considerably (e.g., the respondent is on a new project and has dramatically increased advice seeking over the past year), asking for an average week over that timeframe would be difficult for the employee to answer without again introducing biases around what constitutes an average week. Pre-testing these questions is thus crucial to obtain realistic timeframes that will minimize recall errors and random fluctuations (e.g., avoid holiday seasons) for a specific organizational context.

2.4.2.4. Sender's or receiver's perception of behavior?. When asking about behavior, there might be a difference in perception between the recipient of the behavior and the instigator of the behavior (e.g., an employee might think that a colleague has bullied her, while the colleague might not perceive this as bullying behavior); if you are later hoping to check for tie reciprocation, this might make it difficult to find reciprocity (Hammer, 1985). Some of these misperceptions can also be introduced by how questions are worded. For example, with regard to advice, we might ask, "from whom did you seek advice?" and if we are looking for a reciprocated tie, we must ask the alter "who sought advice from you?" rather than mixing constructs by asking "to whom did you provide advice?" The latter question does not require asking (a person might give advice without it being requested) and the former question does not imply that an answer was provided.

2.4.2.5. Answer categories. Although network researchers often analyze binarized relations (e.g., friend or not), this does not mean that binary answer categories are preferable when collecting network data. First, for network analyses to be meaningful, you would want some alters to be named, but need to ensure that not all are named. That is, you want a certain density, but not a full network as this would be rather uninformative. Asking a binary question, like "with whom do you communicate?" and providing a simple check box might tempt some respondents to name everyone on their organization's roster, even those with whom they communicate only rarely, which renders their responses useless. Pretesting ensures that the answer category generates only enough ties and avoids maximally complete responses.

A situation where multiple "exclusive" answer categories are used (rather than a simple binary answer) allows you to be flexible later about the level at which to dichotomize the data and might provide more accurate results (Ferligoj and Hlebec, 1999). For example, using communication anchors such as "(1) never", "(2) less than once a month", "(3) 1–3 times a month", "(4) 1–3 times a week", "(5) daily" allows you to specify what "frequent" communication is behaviorally prior to dichotomizing, and being able to test your results' robustness using different cut-points. However, it is important to note that providing a set of options is likely to make respondents consider the middle category as a point of reference (Payne, 1951; Schwarz et al., 1985), so pretesting the categories within the organizational context is important. Employing multiple answer categories also allows researchers to access nuanced answers involving sensitive information. For example, if your research seeks to elicit dislike ties and you simply present a single checkbox for "dislike," you are unlikely to elicit many ties; however using a multiple category scale such as "dislike a lot", "dislike", "dislike a little", "like a little", "like", "like a lot" tends to generate greater numbers of negative tie responses because the problem of social desirability is reduced by the availability of stronger negative scale categories (Yang et al., 2019).

2.4.2.6. Roster of names or name generator questions?. Challenging to many network data collections is how to elicit answers, and ensuring that respondents recall their contacts (see Brewer, 2000 for an overview of studies on recall-eliciting of networks). There are three main approaches here, beginning with an open approach where you ask respondents to name all alters with whom they have a specific network relation (i.e. use a name generator). Such an approach might seem most logical when dealing with a large organization involving many potential alters and yet where only a few people will probably be named. In such cases, a limit is sometimes provided to how many alters can be named. This might be useful when aiming to name, for example, one's five most influential colleagues.

There are a number of drawbacks to using such a name generator approach. First there is the issue of different egos using different names to refer to the same alters (e.g., Richard Smith and Dick Smith, while referring to the same person, which makes it difficult to establish unique identifiers for each network member. It is also impossible to know whether the respondent considered all alters that the researcher was interested in (cf., the boundary specification problem). If you fear that this might generate problems, you can include the relevant boundary in your name generator; for example, the boundary can be defined as "all coworkers," "in your subsidiary," (Hansen et al., 2005) or "in your firm" (Lazega, 2001). Using a name generator approach, it is also often

impossible to track any item nonresponse; i.e. if an alter is not named, it is assumed that the respondent does not have that specific relation with the alter, but this could also be missing information related to poor recall. More generally, if no alters are named at all, it is assumed that nobody is "relevant" for the respondent, but this might actually be the result of nonresponse on this network question.

These issues highlight why the roster approach is used often in organization science. This approach involves listing all names of alters within the organization or organizational unit and then providing answer options for each alter. It ensures (at least in principle) that respondents went through all the names that the researcher considers relevant, and would also allow the researcher to identify any missing answers. However, such an approach has its own drawbacks. First, the researcher must provide an accurate and full list of names, because missing names (which can occur if you are, for example, relying on an outdated list provided by HR) will come across as non-professional and being uninformed, which can generate frustration from the respondent and might ultimately make them drop out during the study. Moreover, the full roster needs to allow respondents to distinguish accurately between alters who have very similar names. One option that might make it easier and more accurate is to organize the roster names by department or by function as respondents tend to think this way. Another approach is to use photographs next to roster names (e.g., when you ask questions about weak ties), although this can bias responses if the photographs are not uniform (e.g., smiling people attract more ties). Overall, this approach can remain burdensome when a long list of alters exist and many would not be relevant.

A two-step approach is also used at times: in the first step, names are elicited; in the second step, further probing questions are asked. In the first step, a general name generator tends to be used (e.g., "Whom do you know?" or "With whom do you communicate?" and then a name interpreter is needed focusing on the "quality" of the relation (e.g., "How well do you know this person?" or "How do you feel about this person?"). Note that this two-step approach creates a "piping question" where if a person is not named in the first step, no information about potential alters who were not named is elicited in the second step. It is important in that case that the first question captures all relevant people that are used in subsequent questions. An example of a problem which could emerge when asking "With whom do you work directly?" in the piping question and then asking "Do you like/dislike the person?" in the second step is that respondents might not work with an alter that they like or dislike, but yet this alter has great impact on them in the workplace. These impactful alters would not be captured in this question design.

A final hybrid option mixing roster approaches with name generators is sometimes used, especially where pre-tests have shown that most people named are within the same unit as the respondent. Here we might use the roster approach listing all possible alters within the unit, and then use an open name generator approach for alters outside the unit. In some cases, it might even be sufficient to just know how many alters the person knows in a different unit (e.g., to calculate network range), rather than requesting a specific name from the respondent.

2.4.3. Approaching employees: Social Network Survey Lab methods

Social network analysis works best when there is a substantial response rate (Borgatti et al., 2006; Kossinets, 2006). This is especially the case for complete network data, because we are then interested in understanding how everyone in the organization is connected with everyone else. If there is a great deal of missing data, the results can become unreliable and might potentially no longer be valid.[1] Network researchers view each respondent as unique and there is less conviction that we have a "representative sample" when there are a lot of non-respondents or that we can easily impute the missing data that would assist in network analysis. In contrast, traditional psychometric surveys can often make do with much lower response rates (e.g., 60 %) as long as the respondents are deemed representative of non-respondents (see Sivo et al., 2006, for a discussion). Thus, we need methods to generate very high response rates while ensuring that the surveys remain voluntary and confidential.

This is the problem context in which we developed "survey labs" – small group meetings with potential respondents generally lasting about an hour where: the research project is explained in detail; attendees learn how their data will be collected, stored, and used; and, attendees are afforded the opportunity to ask any questions prior to giving informed consent. These survey labs are a labor- and time-intensive approach to increasing response rates to 80–100 %. They can be contrasted with more typical approaches to network survey data collection where surveys are placed in an online format and then an invitation is sent via mass emails to all potential respondents with a request from management to complete the survey; this latter approach, in our experience, tends not to generate very high response rates, making the extra investment in running data labs a wise choice.

2.4.3.1. Network Survey Data Labs procedure. Top management sets aside a space for the research team to conduct the data lab. This is often a conference room, with a capacity of 8–10 employees, internet connectivity, sufficient notebook computers to host the online survey, and a setup that allows the researcher to conduct a PowerPoint presentation (or a Zoom meeting for remote workers). A schedule is then created to bring in all employees to hear about the research project and take the survey; the presentations occur every 90 minutes during a day, which gives the research team time to present the project, have the respondents take the survey, and then reset the conference room for the next set of respondents. Top management works with lower-level managers to create the schedule; rather than have all the members of a single unit come to the same presentation, which would often create a great deal of organizational disruption, each presentation is held with a cross-functional, cross-unit group of individuals that might be very unfamiliar with each other. This has the additional benefit of having employees feel a greater sense of confidentiality as compared to completing a network survey in the presence of their usual work colleagues.

The very first presentation is the most important one as it sets the tone for the remaining presentations. Individuals attending this first session will often walk out of the session and immediately begin describing the project and whether they participated with other employees who have not yet taken the survey. Top and middle managers need to identify the employees who would potentially be most critical of participating in this type of research project and invite them to this first presentation. Rather than allotting only an hour for this first presentation, set aside two hours; the extra hour of time allows these usually-resistant individuals to ask as many questions of the research team as they have up front. As mentioned previously, it is important for the research team to answer truthfully and completely, without concern to whether this "primes" the participants to know what the project is

[1] This depends to some extent on how much of the data is missing at random and whether an approach can be employed that takes account of the missing data (e.g., Koskinen et al., 2013; de la Haye et al., 2017; Krause et al., 2020). Once the information is collected, it is crucial to deal with missing data. One way to check for response bias could be to look at the nominations by others. For example, non-respondents might be more isolated in the network, or might have more negative ties reported by others (Robins et al., 2004).

covering. Rather, this should be viewed as a trust building exercise between the researchers and the participants, one undertaken to minimize potential negative rumours about the project that might reduce response rates from employees in later scheduled data labs.

After completing this initial presentation, the main body of presentations to introduce the research take place. All employees are encouraged and scheduled by their manager to attend at least one presentation. Additional presentation times are set aside on the final two days of the data collection that are open without a scheduled appointment to capture any employees that were unable to attend their originally-scheduled presentation. Managers are not informed as to who did or did not attend the presentations; the managers' only role is to create the original schedule.

The presentations during these data labs are generally straightforward: Employees are first welcomed and encouraged to ask as many questions as they have, and the time expectations are described. The researcher's role (e.g., consultant, basic researcher, organizational development researcher) and any remuneration being provided through the company or grants need to be identified explicitly so that respondents will know if their work will be used for purely academic purposes, for potential business purposes such as restructuring, or some combination of both. The research project is then explained; prior network analyses in organizations are shown. This step allows employees to see that particular individuals need not be identified in order for the SNA to be valuable to the organization. Then the current study questions are detailed and the group can engage in a discussion with the researchers about the hypotheses if they choose. We find that while the participants often don't have the background in SNA to evaluate the research, they are most interested in testing whether the researcher is being honest with them, as it helps them to determine whether to reveal potentially derogatory or embarrassing social information.

The voluntary and confidential nature of the research is then detailed. An important distinction to explain to participants is the difference between confidential and anonymous research. In general, social network research will be confidential in that we will not allow individual responses to be seen by others; however, the research cannot be anonymous because each node must be tagged with an identifying code in order to assemble the entire network. Respondents are then shown how temporary identification codes are used to form the network and how names are not stored. If an agreement to show names has been made with management, this is also the moment to reveal that fact (although, as we've argued earlier, this is not an ideal approach to conducting research).

Respondents are then shown a description of what will be on the survey, including screenshots of the survey where they see how to complete the sociometric questions. It is important to emphasize at this stage how you would like them to answer questions (e.g., suggesting that they only select as friends those people with whom they would form a relationship outside work), again allowing participants to ask clarifying questions.

At this point, the initial informed consent is obtained and the respondents take the survey. One oddity about how the informed consent process is managed typically in the U.S. is that informed consent is obtained prior to survey administration, with instructions that the respondents can drop out at any time. However, we have found that, on occasion, individuals might wish to complete the entire survey and then withdraw consent and have their entire response wiped out of the database. We allow them to do this by not collecting the previously-signed informed consent forms until the survey administration is complete, at which time the participants can check a box asking to have their responses stricken from the database, which we accommodate immediately after their group leaves the room. While not a common occurrence, it does happen on occasion that those participants in the room do not wish the other respondents to see them choosing not to participate; taking the survey and then denying consent is one way they can preserve their right to confidentiality for participation. The above presentation can also be conducted over Zoom or MSTeams with potential respondents sitting in a conference room in a remote location and with the pre- and post- informed consent options presented in the online survey on the first and final screen (Couper, 2000; Crawford et al., 2001).

This network data lab procedure is very time- and labor-intensive; running five data labs per day (two in the morning and three in the afternoon) with up to eight participants per lab (minus those participants who cannot come to their normally-scheduled time) can take around 7 business days to work through a 200-person unit. However, given how important very high response rates are for SNA, especially when we are collecting longitudinal datasets, we believe the effort is justified.

2.5. *Providing feedback to the organization and its members*

Debriefing the study is important to the organization, the study's main proponents (especially the top management champion), and to all respondents. Central to this element is offering advice to the organization and employees on how to improve shortcomings that the study uncovered without violating organizational members' confidentiality and ethical concerns. If the researcher is engaged in a complete organization development project, this feedback might serve as the underpinning of the action-planning and execution stages for organizational change; otherwise, the researcher might terminate their role with the organization after delivering the feedback (Kolb and Frohman, 1970).

The biggest challenge at this stage is deciding what can and cannot be revealed to management and employees. For example, we have been in the situation where we identified that there was a particular middle manager in the organization that had an exceptionally high flow betweenness centrality score and was a major bottleneck in the manufacturing organization. However, identifying the specific individual would have violated our human subjects review agreement. The network diagram that accompanied this recommendation intentionally did not identify specific individuals or even specific functions to keep people from attempting to guess about the individual's identity. Instead, we offered a broader analysis of the situation, which was that there were too many bottlenecks generally, and that these tended to be in middle management and developed jointly with management a plan for training and developing managers' ability to delegate responsibilities to lower levels as part of a broader employee engagement and development program.

We also find that when we are providing information back to the unit level, small units of five or fewer individuals should not be reported out because it's too easy to identify specific members; instead the unit's information should be aggregated into a set of miscellaneous units. While this might render the quantitative information meaningless, it can still be useful later if recommending how to redesign the organizational structure. Of course, if you are approaching an organization where the work tends to be organized almost entirely around small groups (e.g., environmental consulting firms), the inability to report out results from SNA might mean that is an inappropriate technique and it might be best not to engage with that type of organization in the first place.

Another interesting set of issues around feedback is to whom it is delivered, at what point, and how much control do the researchers retain over what is released to organizational members. The natural inclination for top managers is to have the feedback delivered to them first; some might choose for the feedback process to end there, while others might recognize the importance of sharing it with employees, particularly if their commitment to future rounds of data collection will be sought. From an organization development perspective, feedback should be provided to all parties involved in the study as they are all partners in the work. If top managers hoard the findings, it can reinforce or even induce a sense of cynicism and betrayal that leads to project failure. However, even when top management agrees to provide feedback broadly, they might seek to delay sending out the feedback broadly in order to "prepare" the organization; these delays should be accommodated within reason. The researcher should also offer to work with top management

on crafting the preparation steps for the organization to see the feedback. Some organizations will insist on providing the feedback to their own employees on their own; while the sentiment is understandable, organizations tend to lack the appropriate knowledge base to convey and frame complicated SNA results to organizational members. Thus, it would be best if the research team works collaboratively with management to find the best way to convey the results accurately and yet in a manner that helps the organization to improve its future functioning while avoiding unnecessary distress or resistance. Generally, if there has been a lot of up-front negotiation on how the feedback process will occur, there will be fewer of these issues and negotiations that take place later.

In some instances, it might be important in and of itself to provide feedback to other organizational members. The researchers might in such cases see the feedback as an instance to reflect with the respondents about the found results, and this might be an instance to collectively make sense of the results and even come up with solutions, which can then be reported back to senior management.

3. Conclusion

Collecting social network data among organization members is challenging and requires a well-considered strategy. We have identified four major elements that need our attention when collecting data in organizations: 1) negotiating access to the organization; 2) identifying the network's boundary, the relevant formal organizational structures that affect social networks, and the sampling approach; 3) deciding how to approach research subjects and collect data; and, 4) providing useful and ethically-sensitive feedback to the organization and its members. Each of these are impacted by the aim of the research, i.e. (1) identifying the people being studied and the dyads of interest; (2) the generalizability/scope of the study; and (3) defining the level of analysis (dyad, individual or group). Making certain that the four major elements of the data collection process are all aligned with the specific research question and objective (as well as aligned with each other) is key to a successful network data collection in an organizational setting.

A first important element for conducting successful organizational research using SNA that we have focused on is the need to develop a good strategy for approaching organizations. We have argued why it is essential to motivate and convince organizations to participate, i.e. gaining the appropriate level of commitment from top management prior to data collection. We also discuss the importance of identifying from the beginning what will and can be offered to organizations and their members in return for participation, and especially to clarify issues regarding confidentiality and research ethics. It is important that throughout this process you have a clear idea of what is essential to get out of the project yourself and only continue with the project if it remains achievable.

The strategy needed will depend on the study's cost to the organization, any potential desire on your university's part for funding to support the study, and the benefits that can be provided to the organization. If limited contributions are needed from organizations (e.g., when each organization is only asked to provide access to a few teams), it might be sufficient to offer some relatively simple comparison among the sampled employees on simple psychometric measures of well-being and commitment among companies you are using in your study as benchmarks. However, if an extensive investment is required from the company in employee time and organization (e.g., because you want to collect data among all members of a relatively larger organization) and potentially even consultancy fees for yourself and/or your university, then a more detailed negotiation will be needed to provide greater return for the organization, and likely more input from the company on the questionnaire. A higher return for the company might also mean more engagement from the company in the study and this might result in higher commitment from both management and employees. Therefore, such an approach might also provide a win-win situation, with more detailed data. Hence, negotiating access will vary by the "costs" to the organization. Of course, such an investment from a researcher might not be realistic if the aim is to collect similar data from many companies.

A second important element includes identifying *a priori* clear network boundaries (Laumann et al., 1983; Marsden, 1990) of who will be included or excluded from the study based on the research question of interest. In addition, we must identify the formal structures that create structured foci (Shipilov et al., 2014) for interaction within the network, which will allow us to distinguish voluntary from organizationally-mandated interaction prior to collecting network data. Such formal structures might be important within teams, inside the broader organization, between departments, and even between organizations. In most cases it is not wise to simply rely on the information provided by the centralized functions of the organization (e.g., HR), as information regarding formal structure and membership of units might be incomplete or out of date. Given the research aim and in particular the scope of the study, we have also argued the importance of deciding whether to use a dyadic sampling, an ego-network sampling, a snowball sampling, a cluster sampling, a multistage sampling or a complete network approach. Ego-network sampling might make sense when the analysis is at the nodal level and the measures are local (such as degree and constraint). Dyadic sampling might seem an option for dyadic analysis (especially when conducting an intergroup study); however, one should be aware that dyadic ties are often embedded in a broader structure. In many cases we might want to collect complete network data, although these might involve cluster-sampling (teams), or even hybrid approaches, such as sampling teams among a sample of organizations.

We then turned to the important considerations in collecting SNA survey data. Incorporating the most appropriate network questions in the survey, is essential for a successful result, as is finding strategies to minimize non-response. The choice between a roster or name generator will be guided mainly by whether you are applying an ego-network sample or a complete network, and this itself depends on the research question. For example, we will logically need name generators for interorganizational ties, as the interest is in ties to many other organizations. The choice of network questions also has major consequences on the methods being used. Many of the choices in questionnaire design require pre-testing and exploration with members of the organization. For example, collect information about conflict within teams will require careful question phrasing, often with multiple (Likert-like) answer categories.

We focused on Social Network Survey Lab Methods to collect network data because of their benefits in ensuring high quality responses while keeping non-response to a minimum. These labs allow the researcher to explain the study in greater detail in small group settings with all of the potential respondents and allows trust to be built. This can be especially useful in situations where whole network data are being collected and used for organization development purposes such as organizational redesign, which require commitment from all parties to ensure success.

Finally, we have focused on how to debrief the study results, as it is important to the organization, the study's main champions, and to respondents. Central to this last element is offering advice to the organization on how to improve shortcomings that the study uncovered without violating organizational members' confidentiality and ethical concerns. Throughout this work, we have relied on an organization development model (e.g., Kolb and Frohman, 1970) as the guiding framework for using SNA in work organizations. This approach emphasizes that the researcher should work closely with the organization to conduct research that positively involves all members of the organization and that ultimately is used to improve the workplace. While the extent to which you might be involved with the organization throughout the project will necessarily depend on how much you are asking of the organization in order to conduct the research and the extent to which the organization has dedicated resources to your project (including

payments to you and your university), conducting debriefings and being available to the organization even after the project ends is often very useful. We have found these long-term engagements to be opportunities that often generate new ideas for future research which are based on real-world experience.

While we have discussed each element in turn it is crucial to emphasize that decisions regarding each element cannot be made without taking into account the other elements. For example, decisions about questionnaire design are linked to one's choice of research question, and also to the sampling procedure, while also affecting the manner in which the Data Labs are organized. Decisions on each of these elements and their co-alignment, particularly with respect to the chosen research question, are crucial to maximizing the chances for a successful social network study in an organizational context.

References

adams, j., 2019. Gathering Social Network Data. Quantitative Applications in the Social Sciences. Sage.

Agneessens, F., 2021. Dyadic, nodal and group-level approaches to study the antecedents and consequences of networks: which social network models to use and when? In: Light, Ryan, Moody, James (Eds.), The Oxford Handbook of Social Networks. Oxford University Press, pp. 188–218.

Agneessens, F., Wittek, R., 2012. Where do intra-organizational advice relations come from? The role of informal status and social capital in social exchange. Soc. Networks 34 (3), 333–345.

Aguinis, H., Burgi-Tian, J., 2021. Measuring performance during crises and beyond: the Performance Promoter Score. Bus. Horiz. 64 (1), 149–160.

Arena, M.J., 2018. Adaptive Space: How GM and Other Companies Are Positively Disrupting Themselves and Transforming Into Agile Organizations. McGraw Hill, NY.

Baer, M., Evans, K., Oldham, G.R., Boasso, A., 2015. The social network side of individual innovation: a meta-analysis and path-analytic integration. Organ. Psychol. Rev. 5 (3), 191–223.

Balkundi, P., Harrison, D.A., 2006. Ties, leaders, and time in teams: strong inference about network structure's effects on team viability and performance. Acad. Manag. J. 49 (1), 49–68.

Barsky, N.P., 1999. A core/periphery structure in a corporate budgeting process. Connections 22 (2), 22–29.

Berdahl, J.L., Anderson, C., 2005. Men, women, and leadership centralization in groups over time. Group Dyn. Theory Res. Pract. 9 (1), 45.

Bernard, H.R., Killworth, P., Sailer, L., 1981. Summary of research on informant accuracy in network data and the reverse small world problem. Connections 4 (2), 11–25.

Bernard, H.R., Killworth, P., Kronenfeld, D., Sailer, L., 1984. The problem of informant accuracy: the validity of retrospective data. Annu. Rev. Anthropol. 13, 495–517.

Borgatti, S.P., 2005. Centrality and network flow. Soc. Networks 27 (1), 55–71.

Borgatti, S.P., Halgin, D.S., 2011. On network theory. Organ. Sci. 22 (5), 1168–1181.

Borgatti, S.P., Molina, J.L., 2005. Toward ethical guidelines for network research in organizations. Soc. Networks 27 (2), 107–117.

Borgatti, S.P., Carley, K., Krackhardt, D., 2006. Robustness of centrality measures under conditions of imperfect data. Soc. Networks 28, 124–136.

Borgatti, S.P., Mehra, A., Brass, D.J., Labianca, G., 2009. Network analysis in the social sciences. Science 323 (5916), 892–895.

Bradburn, N.M., Sudman, S., 1974. Response Effects in Surveys: a Review and Synthesis. Aldine Publishing Company, Chicago.

Brass, D.J., 1984. Being in the right place: a structural analysis of individual influence in an organization. Adm. Sci. Q. 29, 518–539.

Brass, D.J., 2012. A social network perspective on organizational psychology. In: Kozlowski, Steve W.J. (Ed.), The Oxford Handbook of Organizational Psychology. Oxford University Press, pp. 667–695.

Brewer, D., 2000. Forgetting in recall-based elicitation of personal and social networks. Soc. Networks 22, 29–43.

Burt, R.S., 1980. Cooptive corporate actor networks: a reconsideration of interlocking directorates involving American manufacturing. Adm. Sci. Q. 25, 557–582.

Burt, R.S., 1984. Network items and the general social survey. Soc. Networks 6 (4), 293–339.

Burt, R.S., 2000. The network structure of social capital. Res. Organ. Behav. 22, 345–423.

Burt, R.S., Hogarth, D., Michaud, C., 2000. The social capital of French and American managers. Organ. Sci. 11 (2), 123–147.

Butts, Carter T., Marcum, Christopher Steven, 2017. A relational event approach to modeling behavioral dynamics. In: Pilny, Andrew, Poole, Marshall Scott (Eds.), Group Processes: Data-Driven Computational Approaches. Springer International Publishing, Cham, Switzerland, pp. 51–92.

Cannell, C.F., Kahn, R.L., 1968. Interviewing. In: The Handbook of Social Psychology, vol. 2, pp. 526–595.

Contractor, N.S., Wasserman, S., Faust, K., 2006. Testing multitheoretical, multilevel hypotheses about organizational networks: an analytic framework and empirical example. Acad. Manag. Rev. 31 (3), 681–703.

Couper, M., 2000. Websurveys: a review of issues and approaches. Public Opin. Q. 64, 464–494.

Crawford, S., Couper, M., Lamias, M., 2001. Web surveys: perceptions of burden. Soc. Sci. Comput. Rev. 19, 146–162.

Cronin, B., Perra, N., Rocha, L.E.C., Zhu, Z., Pallotti, F., Gorgoni, S., Conaldi, G., De Vita, R., 2020. Ethical implications of network data in business and management settings. Soc. Networks.

Cropper, S., Ebers, M., Huxham, C., Ring, P.S. (Eds.), 2008. The Oxford Handbook of Inter-Organizational Relations. Oxford Handbooks.

Cross, R.L., Parker, A., 2004. The Hidden Power of Social Networks: Understanding How Work Really Gets Done in Organizations. Harvard Business Press.

Cross, R., Borgatti, S.P., Parker, A., 2001. Beyond answers: dimensions of the advice network. Soc. Networks 23 (3), 215–235.

Cross, R., Borgatti, S.P., Parker, A., 2002. Making invisible work visible: using social network analysis to support strategic collaboration. Calif. Manage. Rev. 44 (2), 25–46.

de Jong, S.B., Van der Vegt, G.S., Molleman, E., 2007. The relationships among asymmetry in task dependence, perceived helping behavior, and trust. J. Appl. Psychol. 92 (6), 1625.

de Klepper, M.C., Labianca, G., Sleebos, E., Agneessens, F., 2017. Sociometric status and peer control attempts: a multiple status hierarchies approach. J. Manag. Stud. 54 (1), 1–31.

de la Haye, K., Embree, J., Punkay, M., Espelage, D.L., Tucker, J.S., Green Jr, H.D., 2017. Analytic strategies for longitudinal networks with missing data. Soc. Networks 50, 17–25.

DeJordy, R., Halgin, D., 2008. Introduction to Ego Network Analysis. Boston College and the Winston Center for Leadership & Ethics., Boston MA.

Doreian, P., Woodard, K.L., 1992. Fixed list versus snowball selection of social networks. Soc. Sci. Res. 21 (2), 216–233.

Eisenhardt, K.M., 1989. Building theories from case study research. Acad. Manag. Rev. 14 (4), 532–550.

Ellwardt, L., Labianca, G.J., Wittek, R., 2012. Who are the objects of positive and negative gossip at work?: a social network perspective on workplace gossip. Soc. Networks 34 (2), 193–205.

Erdogan, B., Bauer, T.N., Walter, J., 2015. Deeds that help and words that hurt: helping and gossip as moderators of the relationship between leader–member exchange and advice network centrality. Pers. Psychol. 68 (1), 185–214.

Fang, R., Landis, B., Zhang, Z., Anderson, M.H., Shaw, J.D., Kilduff, M., 2015. Integrating personality and social networks: a meta-analysis of personality, network position, and work outcomes in organizations. Organ. Sci. 26 (4), 1243–1260.

Ferligoj, A., Hlebec, V., 1999. Evaluation of social network measurement instruments. Soc. Networks 21 (2), 111–130.

Ferrin, D.L., Dirks, K.T., Shah, P.P., 2006. Direct and indirect effects of third-party relationships on interpersonal trust. J. Appl. Psychol. 91 (4), 870–883.

Fischer, C.S., 1982. What do we mean by 'friend'? An inductive study. Soc. Networks 3 (4), 287–306.

Frank, O., Snijders, T., 1994. Estimating the size of hidden populations using snowball sampling. J. Off. Stat. Stockholm 10, 53-53.

Freeman, L.C., Romney, A.K., Freeman, S.C., 1987. Cognitive structure and informant accuracy. Am. Anthropol. 89 (2), 310–325.

Friedkin, N.E., 1990. A Guttman scale for the strength of an interpersonal tie. Soc. Networks 12 (3), 239–252.

Galbraith, J.R., 2009. Designing Matrix Organizations That Actually Work: How IBM, Proctor & Gamble and Others Design for Success. Jossey-Bass, San Francisco, CA.

Geletkanycz, M.A., Boyd, B.K., 2011. CEO outside directorships and firm performance: a reconciliation of agency and embeddedness views. Acad. Manag. J. 54 (2), 335–352.

Gerbasi, A., Porath, C.L., Parker, A., Spreitzer, G., Cross, R., 2015. Destructive de-energizing relationships: how thriving buffers their effect on performance. J. Appl. Psychol. 100 (5), 1423.

Gile, K.J., Handcock, M.S., 2010. 7. Respondent-driven sampling: an assessment of current methodology. Soc. Methodol. 40 (1), 285–327.

Gonçalves, F.M., Duarte, E.F., dos Reis, J.C., Baranauskas, M.C.C., 2017. An analysis of online discussion platforms for academic deliberation support. July. In: In International Conference on Social Computing and Social Media. Springer, Cham, pp. 91–109.

Goodman, L.A., 1961. Snowball sampling. Ann. Math. Stat. 32 (1).

Goodreau, S.M., Kitts, J., Morris, M., 2009. Birds of a feather, or friend of a friend? Using exponential random graph models to investigate adolescent social networks. Demography 46 (1 Febuary), 103–125.

Greenwood, D.J., Whyte, W.F., Harkavy, I., 1993. Participatory action research as a process and as a goal. Hum. Relat. 46 (2), 175–192.

Hammer, M., 1985. Implications of behavioral and cognitive reciprocity in social network data. Soc. Networks 7 (2), 189–201.

Hansen, M.T., Mors, M.L., Løvås, B., 2005. Knowledge sharing in organizations: multiple networks, multiple phases. Acad. Manag. J. 48 (5), 776–793.

Henttonen, K., Janhonen, M., Johanson, J.E., Puumalainen, K., 2010. The demographic antecedents and performance consequences of the social-network structure in work teams. Team Perform. Manag. 16 (7/8), 388–412.

Hollenbeck, J.R., Beersma, B., Schouten, M.E., 2012. Beyond team types and taxonomies: a dimensional scaling conceptualization for team description. Acad. Manag. Rev. 37 (1), 82–106.

Joshi, A., Labianca, G., Caligiuri, P.M., 2002. Getting along long distance: understanding conflict in a multinational team through network analysis. J. World Bus. 37 (4), 277–284.

Kalish, Y., Robins, G., 2006. Psychological predispositions and network structure: the relationship between individual predispositions, structural holes and network closure. Soc. Networks 28 (1), 56–84.

Kalton, G., Schuman, H., 1982. The effect of the question on survey responses: a review. J. R. Stat. Soc. Ser. A 145 (1), 42–57.
Kane, G.C., Labianca, G., 2011. IS avoidance in health-care groups: a multilevel investigation. Inf. Syst. Res. 22 (3), 504–522.
Kenny, D.A., Kashy, D.A., Cook, W.L., 2006. The Analysis of Dyadic Data. Guilford, New York.
Kilduff, M., Krackhardt, D., 2008. Interpersonal Networks in Organizations: Cognition, Personality, Dynamics, and Culture, vol. 30. Cambridge University Press.
Kim, E., Glomb, T.M., 2014. Victimization of high performers: the roles of envy and work group identification. J. Appl. Psychol. 99 (4), 619.
Kolb, D.A., Frohman, A.L., 1970. An organization development approach to consulting. Sloan Manage. Rev. 12 (1), 51–65.
Koskinen, J.H., Robins, G.L., Wang, P., Pattison, P.E., 2013. Bayesian analysis for partially observed network data, missing ties, attributes and actors. Soc. Networks 35 (4), 514–527.
Kossinets, G., 2006. Effects of missing data in social networks. Soc. Networks 28, 247–268.
Koyrakh, I., Waber, B.N., Olguın, D.O., Pentland, A.S., 2008. Identifying Speech and Conversations in Wearable Sensor Networks. https://vismod.media.mit.edu/tech-reports/TR-618.pdf.
Krackhardt, D., 1987. QAP partialling as a test of spuriousness. Soc. Networks 9, 171–186.
Krackhardt, D., 1988. Predicting with networks—nonparametric multiple-regression analysis of dyadic data. Soc. Networks 10 (4), 359–381.
Krackhardt, D., 1990. Assessing the political landscape: structure, cognition, and power in organizations. Adm. Sci. Q. 342–369.
Krause, R.W., Huisman, M., Steglich, C., Snijders, T., 2020. Missing data in cross-sectional networks–An extensive comparison of missing data treatment methods. Soc. Networks 62, 99–112.
Laumann, E.O., Knoke, D., 1986. Social network theory. In: Lindenberg, S., Coleman, J. S., Nowak, S. (Eds.), Approaches to Social Theory. Russell Sage Found., New York, pp. 83–104.
Laumann, E.O., Marsden, P.V., Prensky, D., 1983. The boundary specification problem in network analysis. In: Burt, R., Minor, M. (Eds.), Applied Network Analysis: A Methodological Introduction. Sage, Beverly Hills.
Lazega, E., 2001. The Collegial Phenomenon: the Social Mechanisms of Cooperation among Peers in a Corporate Law Partnership. Oxford University Press on Demand.
Lerner, J., Lomi, A., 2020. The free encyclopedia that anyone can dispute: an analysis of the micro-structural dynamics of positive and negative relations in the production of contentious Wikipedia articles. Soc. Networks 60, 11–25.
Marineau, J.E., 2017. Trust and distrust network accuracy and career advancement in an organization. Group Organ. Manag. 42 (4), 487–520.
Marineau, J.E., Labianca, G.J., Brass, D.J., Borgatti, S.P., Vecchi, P., 2018. Individuals' power and their social network accuracy: a situated cognition perspective. Soc. Networks 54, 145–161.
Marsden, P.V., 1990. Network data and measurement. Annu. Rev. Sociol. 16, 435–463.
Mehra, A., Kilduff, M., Brass, D.J., 2001. The social networks of high and low self-monitors: implications for workplace performance. Adm. Sci. Q. 46 (1), 121–146.
Methot, J.R., Melwani, S., Rothman, N.B., 2017. The space between us: a social-functional emotions view of ambivalent and indifferent workplace relationships. J. Manage. 43 (6), 1789–1819.
Mizruchi, M.S., Marquis, C., 2006. Egocentric, sociocentric, or dyadic? Identifying the appropriate level of analysis in the study of organizational networks. Soc. Networks 28 (3), 187–208.
Nadel, S.F., 1957. The Theory of Social Structure. Cohen & West Ltd., London.
Oh, H., Chung, M.H., Labianca, G., 2004. Group social capital and group effectiveness: the role of informal socializing ties. Acad. Manag. J. 47 (6), 860–875.
Pattison, P.E., Robins, G.L., Snijders, T.A., Wang, P., 2013. Conditional estimation of exponential random graph models from snowball sampling designs. J. Math. Psychol. 57 (6), 284–296.
Payne, S.L., 1951. The Art of Asking Questions. Princeton University Press, Princeton.
Pelled, L.H., Eisenhardt, K.M., Xin, K.R., 1999. Exploring the black box: an analysis of work group diversity, conflict and performance. Adm. Sci. Q. 44 (1), 1–28.
Perry, B.L., Pescosolido, B.A., Borgatti, S.P., 2018. Egocentric Network Analysis: Foundations, Methods, and Models, vol. 44. Cambridge university press.
Podolny, J.M., Baron, J.N., 1997. Resources and relationships: social networks and mobility in the workplace. Am. Sociol. Rev. 673–693.
Presser, S., Couper, M.P., Lessler, J.T., Martin, E., Martin, J., Rothgeb, J.M., Singer, E., 2004. Methods for testing and evaluating survey questions. Public Opin. Q. 68 (1), 109–130.
Reichheld, F.F., 2003. The one number you need to grow. Harv. Bus. Rev. 81 (12), 46–55.
Richards, W.D., 1985. Data, models, and assumptions in network analysis. In: McPhee, R. D., Tompkins, P.K. (Eds.), Organizational Communication: Traditional Themes and New Directions. Sage, Beverly Hills, pp. 108–128.
Rivera, M.T., Soderstrom, S.B., Uzzi, B., 2010. Dynamics of dyads in social networks: assortative, relational, and proximity mechanisms. Annu. Rev. Sociol. 36, 91–115.
Robins, G., 2015. Doing Social Network Research. Sage.
Robins, G., Pattison, P., Woolcock, J., 2004. Missing data in networks: exponential random graph (p*) models for networks with non-respondents. Soc. Networks 26 (3), 257–283.
Robins, G., Pattison, P., Kalish, Y., Lusher, D., 2007. An introduction to exponential random graph (p*) models for social networks. Soc. Networks 29 (2), 173–191.
Saris, W.E., Gallhofer, I.N., 2014. Design, Evaluation, and Analysis of Questionnaires for Survey Research. John Wiley & Sons.
Schwarz, N., Hippler, H.J., Deutsch, B., Strack, F., 1985. Response scales: effects of category range on reported behavior and comparative judgments. Public Opin. Q. 49 (3), 388–395.
Shipilov, A., Labianca, G., Kalnysh, V., Kalnysh, Y., 2014. Network-building behavioral tendencies, range, and promotion speed. Soc. Networks 39, 71–83.
Sivo, S.A., Saunders, C., Chang, Q., Jiang, J.J., 2006. How low should you go? Low response rates and the validity of inference in IS questionnaire research. J. Assoc. Inf. Syst. 7 (1), 17.
Snijders, T.A., 1992. Estimation on the basis of snowball samples: how to weight? Bull. Sociological Methodol. Bull. de Méthodologie Sociologique 36 (1), 59–70.
Snijders, T.A., Van de Bunt, G.G., Steglich, C.E., 2010. Introduction to stochastic actor-based models for network dynamics. Soc. Networks 32 (1), 44–60.
Soltis, S.M., Agneessens, F., Sasovova, Z., Labianca, G., 2013. A social network perspective on turnover intentions: the role of distributive justice and social support. Human Res. Manage. 52 (4), 561–584.
Sparrowe, R.T., Liden, R.C., Wayne, S.J., Kraimer, M.L., 2001. Social networks and the performance of individuals and groups. Acad. Manage. J. 44 (2), 316–325.
Stadtfeld, C., Block, P., 2017. Interactions, actors, and time: dynamic network actor models for relational events. Sociological Sci. 4, 318–352.
Stivala, A.D., Koskinen, J.H., Rolls, D.A., Wang, P., Robins, G.L., 2016. Snowball sampling for estimating exponential random graph models for large networks. Soc. Networks 47, 167–188.
Sudman, S., Bradburn, N.M., 1973. Effects of time and memory factors on response in surveys. J. Am. Stat. Assoc. 68 (344), 805–815.
Sudman, S., Bradburn, N., 1982. Asking Questions: A Practical Guide to Questionnaire Design. Jossey Bass Publishers, San Fransisco.
Tasselli, S., Kilduff, M., Menges, J.I., 2015. The microfoundations of organizational social networks: a review and an agenda for future research. J. Manage. 41 (5), 1361–1387.
Tortoriello, M., Krackhardt, D., 2010. Activating cross-boundary knowledge: the role of Simmelian ties in the generation of innovations. Acad. Manage. J. 53 (1), 167–181.
Tourangeau, R., Rips, L., Rasinski, K., 2000. The Psychology of Survey Response. Cambridge University Press, Cambridge.
Umphress, E.E., Labianca, G., Brass, D.J., Kass, E., Scholten, L., 2003. The role of instrumental and expressive social ties in employees' perceptions of organizational justice. Organization Sci. 14 (6), 738–753.
Van der Poel, M.G., 1993. Delineating personal support networks. Soc. Networks 15 (1), 49–70.
Vu, D., Pattison, P., Robins, G., 2015. Relational event models for social learning in MOOCs. Soc. Networks 43, 121–135.
Weeks, Mr., Clair, S., Borgatti, S.P., Radda, K., Schensul, J.J., 2002. Social networks of drug users in high-risk sites: finding the connections. AIDS and Behavior 6, 193–206.
Westphal, J.D., Boivie, S., Ming Chng, D.H., 2006. The strategic impetus for social network ties: reconstituting broken CEO friendship ties. Strategic Manage. J. 27 (5), 425–445.
Woehler, M.L., Cullen-Lester, K.L., Porter, C.M., Frear, K.A., 2021a. Whether, how, and why networks influence men's and women's career success: review and research agenda. J. Manage. 47 (1), 207–236.
Woehler, M., Floyd, T., Shah, N., Sung, W., Grosser, T.J., Fagan, J., Labianca, G., 2021b. Turnover during a corporate merger: how workplace network change influences staying. J. Appl. Psychol.
Yang, S.W., Trincado, F., Labianca, G., Agneessens, F., 2019. Negative ties in intra-organizational network research: a review and synthesis of the past 25 years. In: Brass, D., Borgatti, S. (Eds.), Social Networks at Work. SIOP Frontiers Series.
Yin, R., 1984. Case Study Research. Sage Publications, Beverly Hills, CA.